UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS

IN RE: CHICAGO BOARD OPTIONS EXCHANGE VOLATILITY INDEX MANIPULATION ANTITRUST LITIGATION *This Document Relates to All Actions*	18-cv-4171 MDL No. 2842 Honorable Manish S. Shah **[CORRECTED] CONSOLIDATED AMENDED CLASS ACTION COMPLAINT** **JURY TRIAL DEMANDED**

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Plaintiffs Richard S. Aaron, Brian Barry, William Tad Berger, Spencer Roland Bueno, Dale Cary, Victor Choa, FTC Capital GmbH, Amy Huang, LRI Invest S.A., John Pels, Projection Capital Markets LLC, and David Samuel (collectively, "Plaintiffs"), individually and on behalf of all others similarly situated, bring this class action based upon personal knowledge of their own acts and upon information and belief as to all other matters alleged herein, including from the investigation of Plaintiffs' counsel, against Cboe Global Markets, Inc., Cboe Futures Exchange, LLC, and the Chicago Board Options Exchange, Inc. (now known as Cboe Exchange, Inc.) (together, "CBOE"), as well as against other unknown persons and entities (the "Doe Defendants").

NATURE OF THE ACTION

1. This case involves CBOE's knowingly flawed design for its VIX Volatility Index (the "VIX") and the suite of products it created based upon the VIX ("VIX Options" and "VIX Futures"). This case also involves the Doe Defendants' exploitation of this flawed design, with CBOE's knowledge, to manipulate the VIX and its related products for their illicit gain and to Plaintiffs' detriment.

2. The VIX, which purports to measure the expected volatility of the S&P 500, is widely known as the U.S. stock market's "fear gauge." Since its inception until the early 2000's, the VIX was just a published figure that could not be traded.

3. But things began to change after CBOE decided that it should become a for-profit enterprise. CBOE's decision coincided with new regulations that required brokers to direct their orders to venues that displayed the best prices. Faced with a threat of declining CBOE fee revenues for products available across multiple trading venues, CBOE needed to drive trading in products *exclusive* to CBOE. It needed a new product that could drive its profitability. That

exclusive product turned out to be a suite of tradeable VIX products, built on CBOE's exclusive license with respect to the S&P 500 index ("SPX").

4. CBOE's exclusive license agreement, however, was not enough to ensure the success of any product CBOE developed out of that license. The lifeblood of any financial product—particularly new ones—is liquidity. Generally, investors are much more likely to trade a product when many other investors are also trading it. When there is insufficient liquidity, there is a far greater risk to traders and investors of not being able to exit a position on what is perceived to be fair terms. Investors either to pay more when buying and accept less when selling, or wait longer to trade. The corollary is that success begets success; once a critical mass of liquidity is reached, more people are willing to trade in that product.

5. CBOE knew that one way to supercharge interest in VIX products was to structure the VIX "Special Opening Quotation" ("SOQ") settlement process such that liquidity providers could easily enter into other transactions to hedge or arbitrage their exposure to VIX products, i.e., to make the VIX "replicable." CBOE took this concept of "replicability" to an extreme. It did so by, among other things, basing the VIX settlement price on a large series of tradeable SPX Options, refusing to base it on a measurement taken over an extended period of time, and giving outsized weight to cheap, far out-of-the-money transactions. This afforded CBOE the market participation (and trading fee profits) it desired for its VIX products. But it also made the settlement process much easier to manipulate because traders could exploit the replicability by trading the same defined set of cheap and thinly-traded SPX Options to move the VIX to artificial levels. As shown below, that is exactly what certain traders did.

6. Ultimately, the VIX suite of products were not merely successful; they became the main driver of CBOE's profits. In fact, VIX Options are the most successful new product in

CBOE history. Between 2007 and 2017, CBOE saw a 3,000% increase in daily VIX Options transactions and over a 15,000% increase in VIX Futures. CBOE's annual report makes clear its 88% rise in "transaction fees" has occurred "primarily" because of volume increases in "proprietary" VIX-related trading. CBOE has repeatedly touted its lineup of SPX and VIX products as its "highest margin products."

7. As the designer of the SOQ, CBOE knew the methodology would invite manipulation. But it proceeded anyway in order to secure and then keep the business of the crucial liquidity providers, and to increase trading in (and fees arising from) its proprietary products. As the administrator of the VIX franchise, with unlimited and near-exclusive access to the underlying trading and settlement data, CBOE was able to see that the flawed SOQ process was, in fact, routinely exploited. CBOE knew exactly what levers the Doe Defendants were pulling and what buttons they were pushing as VIX Options and VIX Futures settlement values were being determined. Multiple sources and analyses confirm this to be the case. But still, CBOE stuck to the flawed system, fearful that changing paths would alienate the very liquidity providers it had enticed into the marketplace. This invited and allowed the Doe Defendants to continue to engage in widespread manipulation of the SOQ process.

8. An academic study in 2017, and a "whistleblower" letter to U.S. regulators in 2018, alleged that multiple suspicious choices CBOE made meant that the VIX and the SOQ process were uniquely vulnerable to manipulation. On February 14, 2018, former Commodities Futures Trading Commission ("CFTC") Commissioner Bart Chilton joined the growing chorus, opining that the allegation that the VIX was manipulated "rings true to me." He added that "there's certainly enough smoke." On February 16, 2018, former Securities Exchange Commission ("SEC") Chairman Harvey Pitt echoed these comments, stating "it's quite clear that

[the VIX] indexes' options can be manipulated. . . . the Cboe, as the marketplace, should have sprung in to action." Multiple regulators, including the CFTC, the SEC, and the Financial Industry Regulatory Authority ("FINRA") are now reported to be investigating the manipulation of VIX-related products.

9. Similarly, while CBOE claims that the SOQ settlement process was driven by free market forces, Plaintiffs have conducted extensive economic analyses that demonstrate that the process was regularly manipulated. Specifically, these analyses show, among other things: (1) the ratio of SPX put options to SPX call options was higher on settlement days than other days, which is relevant as puts have a greater ability to influence the settlement price; (2) trading volume was higher on settlement days, particularly for the deep out-of-the-money SPX Options that carried more weight in the settlement formula; (3) certain traders were placing bids precisely to fill gaps that would otherwise exclude certain option series from the VIX calculation, but *only* during the settlement window; and (4) the VIX moved differently on settlement days than on other days.

10. Belying any notion these phenomena are explainable by natural market forces, the data also show that (5) pricing and quoting behavior changed in February 2018 when it was reported that FINRA was investigating manipulation of the VIX.

11. Primarily with respect to its other products, CBOE has occasionally and belatedly slapped the wrist of mostly minor players. Such actions were based on CBOE's review of the data only it had complete and unfettered access to. The data showed traders had engaged in various manipulative trading practices in the form of "strategy orders" and "safety bids." This confirms that CBOE was able to find, and in fact had actual knowledge of, more widespread problems in the VIX products, because (6) Plaintiffs' analyses also demonstrate that the VIX

settlement process was *routinely* subject to these same trading practices in a way that *CBOE itself* has expressly acknowledged demonstrates manipulation.

12. In the end, for VIX Options and VIX Futures alone, the fraudulent manipulations distorted settlement values to the tune of billions of dollars.

13. By creating, marketing, and maintaining proprietary products that were known to be flawed and that advantaged certain customers over others, CBOE was acting in its role as a profit-seeking enterprise. CBOE is thus liable under the Securities Exchange Act of 1934 ("Exchange Act") for employing a device, scheme, or artifice to defraud Class members.

14. CBOE is also liable under the Commodity Exchange Act ("CEA"), which requires CBOE to enforce rules preventing price manipulation on its exchanges. CBOE failed to enforce its own rules when it deliberately designed, made public, and promoted a process that was vulnerable to manipulation; provided certain favored insiders with specialized tools that made such manipulation easier; and then knowingly allowed investors to be cheated by such manipulation on a weekly basis. Under the CEA, the relevant decision-maker or employer is held responsible for this misconduct, and liability is imputed across corporate entities and up chains of command.

15. The Doe Defendants took advantage of the flawed design created and implemented by CBOE and engaged in the misconduct described below in order to manipulate prices. The Doe Defendants are therefore liable under numerous provisions of the Exchange Act, the CEA, and the Sherman Act.

PARTIES

A. Plaintiffs

16. Plaintiff Richard S. Aaron is an individual residing in London, England. During the Class Period, Mr. Aaron transacted in VIX Options on the CBOE Options Exchange

("COE"). These instruments were manipulated by Defendants' conduct, and Mr. Aaron's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Mr. Aaron was harmed as described in Section V below and suffered economic injury as a result.

17. Plaintiff Brian Barry is an individual who resides in Bali, Indonesia. During the Class Period, Mr. Barry transacted in VIX ETPs. These instruments were manipulated by Defendants' conduct, and Mr. Barry's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Mr. Barry was harmed as described in Section V below and suffered economic injury as a result.

18. Plaintiff William Tad Berger is an individual who resides in Bedford, New Hampshire. During the Class Period, Mr. Berger transacted in VIX ETPs. These instruments were manipulated by Defendants' conduct, and Mr. Berger's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Mr. Berger was harmed as described in Section V below and suffered economic injury as a result.

19. Plaintiff Spencer Roland Bueno is an individual who resides in La Jolla, California. During the Class Period, Mr. Bueno transacted in SPX Options and VIX Options on the COE, and in VIX ETPs. These instruments were manipulated by Defendants' conduct, and Mr. Bueno's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Mr. Bueno was harmed as described in Section V below and suffered economic injury as a result. The Court has appointed Mr. Bueno as Lead Plaintiff on the Exchange Act claims.

20. Plaintiff Dale Cary is an individual who resides in Edmonds, Washington. During the Class Period, Mr. Cary transacted in VIX Options on the COE. These instruments were manipulated by Defendants' conduct, and Mr. Cary's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Mr. Cary was harmed as described in Section V below and suffered economic injury as a result.

21. Plaintiff Victor Choa is an individual who resides in Jericho, New York. During the Class Period, Mr. Choa transacted in SPX Options and VIX Options on the COE, VIX Futures on the CBOE Futures Exchange ("CFE"), and in VIX ETPs. These instruments were manipulated by Defendants' conduct, and Mr. Choa's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Mr. Choa was harmed as described in Section V below and suffered economic injury as a result.

22. Plaintiff FTC Capital GmbH ("FTC Capital") is an asset management company based in Vienna, Austria. During the Class Period, FTC Capital's sub-funds, along with FTC Futures Fund Classic, a sub-fund of FTC Futures Fund SICAV, based in Luxembourg, transacted in VIX Futures on the CFE.[1] These instruments were manipulated by Defendants' conduct, and FTC Capital's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, FTC Capital was harmed as described in Section V below and suffered economic injury as a result.

23. Plaintiff Amy Huang is an individual who resides in Brooklyn, New York. During the Class Period, Ms. Huang transacted in VIX Options on the COE and in VIX ETPs. These instruments were manipulated by Defendants' conduct, and Ms. Huang's transactions

[1] Prior to filing its original complaint in this Action, FTC Futures Fund SICAV assigned the claims of FTC Futures Fund Classic to FTC Capital.

were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Ms. Huang was harmed as described in Section V below and suffered economic injury as a result.

24. Plaintiff LRI Invest S.A. ("LRI Invest") is a fund administrator based in Luxembourg. During the Class Period, LRI Invest's funds transacted in VIX Options on the COE and in VIX Futures on the CFE. These instruments were manipulated by Defendants' conduct, and LRI Invest's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, LRI Invest was harmed as described in Section V below and suffered economic injury as a result.

25. Plaintiff John Pels is an individual who resides in Windsor, California. During the Class Period, Mr. Pels transacted in VIX Options on the COE and in VIX Futures on the CFE. These instruments were manipulated by Defendants' conduct, and Mr. Pel's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Mr. Pels was harmed as described in Section V below and suffered economic injury as a result.

26. Plaintiff Projection Capital Markets LLC is a limited liability company with its headquarters in Brooklyn, New York. During the Class Period, Projection Capital Markets transacted in VIX ETPs. These instruments were manipulated by Defendants' conduct, and Projection Capital Markets' transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Projection Capital Markets was harmed as described in Section V below and suffered economic injury as a result.

27. Plaintiff David Samuel is an individual who resides in Auckland, New Zealand. During the Class Period, Mr. Samuel transacted in VIX ETPs. These instruments were

manipulated by Defendants' conduct, and Mr. Samuel's transactions were adversely impacted by this manipulation. As a direct and proximate result of the wrongdoing alleged herein, Mr. Samuel was harmed as described in Section V below and suffered economic injury as a result.

B. Defendants

28. Defendant Cboe Global Markets, Inc. (formerly known as CBOE Holdings, Inc.) is a corporation organized under the laws of Delaware with its principal place of business in Chicago, Illinois. Cboe Global Markets, Inc. maintains offices around the globe. CBOE Global Markets, Inc. is the publicly traded holding company of, among other entities, CBOE Futures Exchange, LLC (which is responsible for operating the CFE) and the Chicago Board Options Exchange, Inc. (which is responsible for operating the COE).

29. Defendant Cboe Futures Exchange, LLC is a corporation organized under the laws of Delaware with its principal place of business in Chicago, Illinois.

30. Chicago Board Options Exchange, Inc. (now known as Cboe Exchange, Inc.) is a corporation organized under the laws of Delaware with its principal place of business in Chicago, Illinois.

31. Defendants Cboe Global Markets, Inc., Cboe Futures Exchange, LLC, Chicago Board Options Exchange, Inc., and their subsidiaries, officers, and directors are referenced collectively in this Complaint as "CBOE" unless otherwise noted.

32. Doe Defendants are persons and entities that directly or indirectly manipulated or attempted to manipulate the settlement prices of VIX Options and VIX Futures, and the prices of VIX ETPs, including through trading SPX Options during the settlement window for VIX Options and VIX Futures. Trading of VIX Options and SPX Options on the COE, and of VIX Futures on the CFE, is anonymous. Plaintiffs intend to seek leave to amend their complaint upon learning the identity of the Doe Defendants.

JURISDICTION AND VENUE

33. This Court has subject matter jurisdiction over this action pursuant to Section 22 of the CEA (7 U.S.C. § 25) and Section 10(b) of the Exchange Act (15 U.S.C. § 78aa). The Court also has jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1337(a) to recover damages for violation of Sections 1 and 2 of the Sherman Act (15 U.S.C. § 2).

34. This is also a class action arising under the Class Action Fairness Act of 2005 (28 U.S.C. §§ 1332(d), 1453, 1711-1715), which explicitly provides for the original jurisdiction of the Federal Courts over any class action in which any member of the plaintiff class is a citizen of a state different from any defendant, and in which the matter in controversy exceeds in the aggregate of $5,000,000, exclusive of interest and costs. The total claims of the individual members of the Class here are in excess of $5,000,000 in the aggregate, exclusive of interest and costs, as required by 28 U.S.C. § 1332(d)(2)(A).

35. Venue is proper in this District pursuant to Section 22 of the CEA (7 U.S.C. § 25) and Section 10(b) of the Exchange Act (15 U.S.C. § 78aa), and pursuant to Sections 4(a) and 12 of the Clayton Act (15 U.S.C. §§ 15(a), 22; 28 U.S.C. § 1391(b), (c), & (d)). A substantial part of Defendants' acts or omissions occurred in this District, for which Defendants, directly or indirectly, used the means and instrumentalities of interstate commerce, including, but not limited to, the facilities of the national securities markets. All the products at issue in this case represent billions of dollars in interstate commerce each year in the United States.

36. This Court has personal jurisdiction over each Defendant, because: each Defendant was found or resided in this District, had agents in this District, or transacted business throughout the United States, including this District; a substantial part of the events giving rise to Plaintiffs' claims arose in this District; and a substantial portion of the affected interstate trade and commerce described herein has been carried out in this District.

FACTUAL BACKGROUND

A. Futures and Options Contracts

37. An option contract is an agreement that gives the buyer the right—but not the obligation—either to buy (in the case of a "call option") or to sell (in the case of a "put option") a particular commodity or financial instrument, at a predetermined price, at or during a specified time period in the future (the "expiry date"). The agreed price is generally known as the "strike price."

38. A physically settled option requires physical delivery of the underlying financial instrument. For example, many stock options are physically settled, meaning settlement requires actual delivery of the stock to the holder if she exercises the option. A cash-settled option, in contrast, results in a cash payment to the holder of the option based on prevailing market values for the underlying product or instrument at the time of settlement, rather than delivery of the product or instrument.

39. The main driver of whether a cash-settled option is exercised is whether it is "in the money" or "out of the money." An in-the-money option is one where the holder is entitled to a cash payment if she exercises the option. For example, if an option holder has the right to buy a widget at a price of $300 (a call), and the market price for the widget is currently $500, the call option is in the money—because the option holder could make a $200 profit by buying a widget for $300 and immediately selling it for $500.

40. An out-of-the-money put or call is one where the option holder is not entitled to a cash payment if she exercises the option. For example, if an option holder has the right to sell a widget at a price of $300 (a put), and the market price for the widget is currently $500, the option is out of the money—because the opportunity to sell at $300 is worthless when the option holder could sell at $500 on the open market.

41. Whether a put or call option ultimately is in or out of the money depends on the relevant prevailing market price at the time of the settlement of the option—the at-the-money price. In the case of a widget, the at-the-money price is the prevailing market price of a widget. An option can be in or out of the money at one point in time and just the opposite at the time of settlement.

42. Futures contracts involve a promise—generally made through a futures exchange—to buy or sell a particular commodity or financial instrument, at a predetermined price, on a fixed date in the future (i.e., again, on an "expiry date"). Futures can also be cash-settled, instead of requiring physical delivery of the underlying commodity or instrument on the expiry date.

43. Because there is no "SPX" or "VIX" to be physically delivered, SPX Options, VIX Options, and VIX Futures are always cash-settled.

B. The SPX and SPX Options

44. The S&P 500 index is a capitalization-weighted index of 500 U.S. stocks from a broad range of industries. The impact of a component's price change is proportional to the issue's total market value, which is the share price multiplied by the number of shares outstanding.

45. The S&P 500 is widely regarded as the leading benchmark of the overall U.S. stock market, and CBOE is the exclusive provider of options on the SPX ("SPX Options"). CBOE provides a range of SPX Options, including SPX Options with A.M. settlement, with P.M. settlement, weekly options, end-of-month options, and Mini SPX options.

46. SPX Options are available for trading solely on CBOE's COE exchange. Indeed, CBOE markets SPX Options as its "flagship contract" and as "the index option of choice for

institutional investors trading large and complex [S&P 500 options] orders."[2] As CBOE has acknowledged in its public filings with the SEC throughout the Class Period, "[t]he options we offer on the S&P 500 Index are exclusive to CBOE and contribute substantially to our volumes and transaction fees."[3]

47. Like any other option, SPX Options can be either call or put options. They also can be in or out of the money at any given point in time, depending on the market's current expectation of the S&P 500 Index's value in the future. For example, the at-the-money price for an SPX Option that expires in 30 days reflects the market expectation of the level of the S&P 500 in 30 days' time.

48. There is a spectrum of in-the-money/out-of-the-money SPX put and call options, shown below for a hypothetical at-the-money price of $1,000. SPX Option puts that have lower strike prices are more out of the money because the market is less likely to decline to those lower strike prices. Similarly, SPX Option calls that have higher strike prices are more out of the money because the market is less likely to rise to those higher strike prices. This can be seen in the following diagram:

[2] CBOE, *S&P 500 Index*, http://www.cboe.com/products/stock-index-options-spx-rut-msci-ftse/s-p-500-index-options/s-p-500-index.

[3] CBOE, Annual Report 2016, at 12, https://www.cboe.com/framed/pdfframed?content=/aboutcboe/annualreportarchive/annual-report-2016.pdf&section=SEC_ABOUT_CBOE&title=CBOE+Annual+Report+2016.

C. The VIX

49. The VIX is a popular index used to measure the stock market's expectation of volatility and is colloquially referred to as the "fear index" or the "fear gauge." "[W]idely reported by financial media" and "closely followed by a variety of market participants as a daily market indicator,"[4] the VIX is higher when the market is expected to be more volatile 30 days in the future and is lower when the market is expected to be less volatile 30 days in the future.

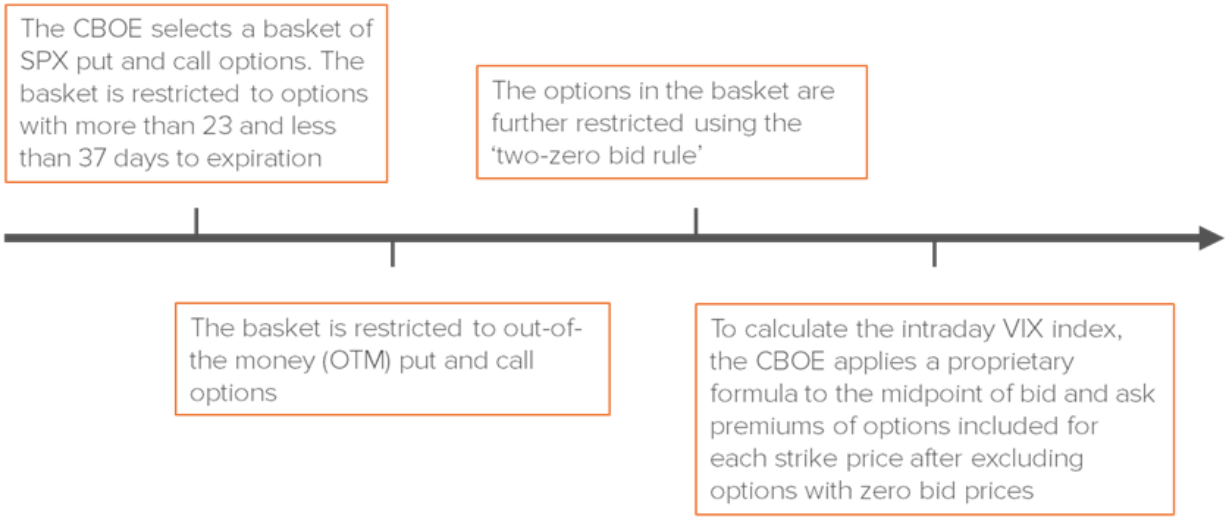
50. The VIX is determined by reference to the prices of SPX Options (the cost of purchasing the options at particular strike prices). This is supposedly because the prevailing quotation levels of SPX Options serve as an indicator of the market's expectations of future stock price volatility. For example, an option to buy or sell the SPX at a given level will be worth more when the market expectation is that stock prices will be volatile, and more likely to move significantly above or below that level. By contrast, it will be worth less when the market expectation is that stock prices will be calm, and less likely to move significantly above or below that level.

[4] CBOE, *VIX*, http://www.cboe.com/vix/.

51. CBOE explains the relation between SPX Options and the VIX on its website:[5]

> The VIX Index is an up-to-the-minute market estimate of implied (expected) volatility that is calculated by using the midpoint of real-time S&P 500® Index (SPX) option bid/ask quotes. More specifically, the VIX Index is intended to provide an instantaneous measure of how much the market thinks the S&P 500 Index will fluctuate in the 30 days from the time of each tick of the VIX Index.
>
> Cboe Options Exchange® (Cboe®) calculates the VIX Index using standard SPX options and weekly SPX options that are listed for trading on Cboe. Standard SPX options expire on the third Friday of each month and weekly SPX options expire on all other Fridays. Only SPX options with Friday expirations are used to calculate the VIX Index. Only SPX options with more than 23 days and less than 37 days to the Friday SPX expiration are used to calculate the VIX Index. These SPX options are then weighted to yield a constant, 30-day measure of the expected volatility of the S&P 500 Index.

52. The VIX calculation process is summarized in the following diagram:



53. The VIX calculation occurs approximately every 15 seconds throughout the trading day and is based upon bid and ask premiums at various strike prices for a number of different SPX Options. To determine which SPX put and call options should be used to calculate the VIX, the calculation process starts from the strike price that is closest to the prevailing at-the-money value and proceeds in both out of the money directions until two zero-bid strike prices are

[5] CBOE, *VIX FAQs*, http://www.cboe.com/products/vix-index-volatility/vix-options-and-futures/vix-index/vix-faqs#1.

reached. The "two-zero bid rule" requires that the basket of SPX put and call options used to determine the value of the VIX must be drawn from puts and calls that are not "zero-bid" two or more times in a row.

54. The following table offers a hypothetical illustration of whether the strike for a series of calls or puts on SPX Options would be included in the VIX calculation upon application of the two-zero bid rule:

Application of the Two-Zero Bid Rule

Put Strike	Bid Premium	Ask Premium	Included in VIX calculation?
1380	0.1	0.2	Yes
1375	0.1	0.15	Yes
1370	0.05	0.35	Yes
1365	0	0.35	No
1360	0	0.35	No
1355	0.05	0.35	Excluded following two zero bids
1350	0.05	0.15	
1345	0	0.15	

Call Strike	Bid Premium	Ask Premium	Included in VIX calculation?
2100	0.05	0.15	Yes
2120	0	0.15	No
2125	0.05	0.15	Yes
2150	0	0.1	No
2175	0	0.05	No
2200	0.05	0.05	Excluded following two zero bids
2225	0.05	0.1	
2250	0	0.05	

55. As this table demonstrates, whether a given strike price or series of strike prices and the attendant bid and ask premium are included in the calculation for the VIX process is dependent on whether participants have chosen to bid on puts or calls at those strike prices.

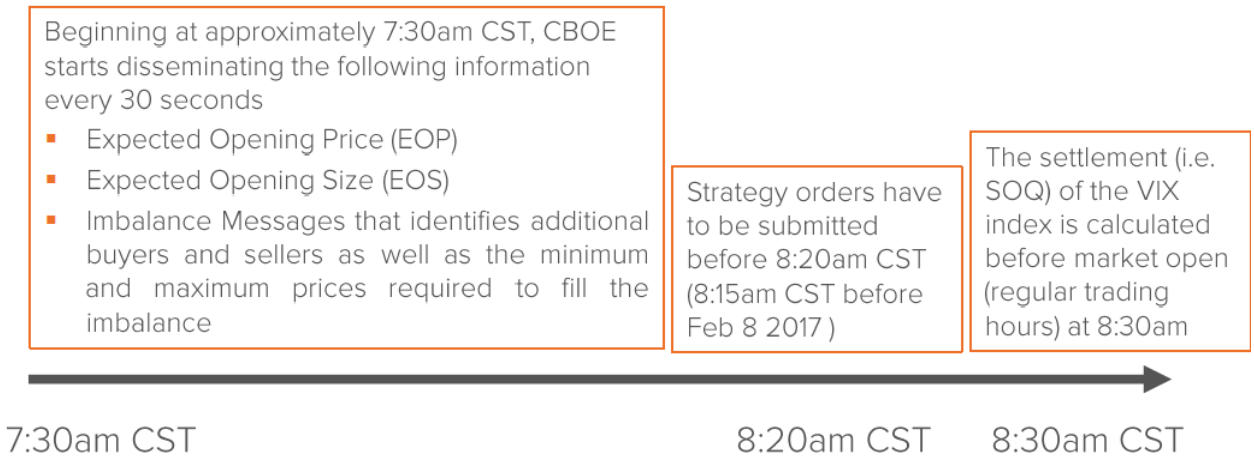
D. VIX Options, VIX Futures, VIX ETPs, and the SOQ Settlement Process

56. Initially the VIX was just a benchmark figure. Investors could not "take a position" in the VIX or on the direction they thought it would go. But CBOE was eager to increase its profits by inviting investors to take positions based on their views of volatility and their attendant expectations regarding movements in the VIX. CBOE did so by creating VIX Futures in 2004 and then VIX Options in 2006. The products—exclusive to CBOE—thereafter

allowed traders and investors to speculate on the extent the stock market, as reflected by the S&P 500, would be more or less volatile in the future.

57. VIX Options can only be exercised at expiration, which occurs every Wednesday since mid-2015 (monthly previously), and all are cash-settled. VIX Futures are also cash-settled at expiry. The cash-settlement value at expiry is determined through the same CBOE-administered SOQ process for both VIX Options and VIX Futures. The SOQ process is similar, but not identical, to the process used to calculate the VIX itself.[6]

58. The SOQ settlement process is conducted by CBOE using a proprietary auction mechanism called the "Hybrid Opening System" (or "HOSS"). The HOSS finds a single clearing price that maximizes the number of contracts that can be traded within the SOQ price range. The following table demonstrates the HOSS auction mechanism within the SOQ process:



[6] In addition to those discussed below, other differences between the intraday VIX calculation and the settlement calculation include that: (1) the VIX is calculated and published every 15 seconds throughout the trading day, whereas the VIX settlement price is calculated on the day that VIX Options and VIX Futures expire; (2) settlement calculations include only SPX Options that expire in exactly 30 days, whereas the intraday VIX computations include SPX Options that expire in the range of 23 to 37 days; and (3) the intraday VIX is derived from the midpoint of bid and ask premiums of SPX Options, whereas the settlement calculations use actual traded prices where possible.

59. With respect to SPX Options, a large amount of control over the bidding and trading process is vested in "Lead Market Makers" appointed by CBOE. Under CBOE Rule 8.15(b)(1), a Lead Market Maker must "provide continuous electronic quotes (as defined in Rule 1.1 (ccc)) in at least the lesser of 99% of the non-adjusted option series or 100% of the non-adjusted option series minus one call-put pair."

60. In 2008, for the first time, CBOE designated dual Lead Market Makers for SPX Options. In October of 2012, it expanded the Lead Market Maker structure for SPX Options so that more than two but no more than four Lead Market Makers could be designated. In 2014, CBOE introduced extended trading hours for both SPX Options and VIX Options. In that year and subsequent years, it designated three Lead Market Makers for each.

61. Lead Market Makers (and all other classes of market maker) are eligible to participate in the SOQ. However, as per CBOE rule 8.15(b)(v), Lead Market Makers are obliged to "enter opening quotes within one minute of the initiation of an opening rotation in any series that is not open due to the lack of a quote." In other words, if no one else participating in the SOQ offers a quote, Lead Market Makers are obligated to do so. Certain market makers are given steep discounts for quoting out-of-the-money SPX Options. This is a feature not seen in other, comparable options contracts.

62. CBOE keeps confidential the identity of the participants in the SOQ process. However, according to CBOE Rule 8.13, Lead Market Makers are required to enter opening quotes for SPX Options. According to CBOE Rule 8.85, "Designated Primary Market Makers" are required to enter opening quotes for SPXW options (i.e., weekly SPX Options).

63. Both the orders and quotes of Lead Market Makers and Designated Primary Market Makers are eligible to participate in the SOQ. By contrast, all other market participants

participate in the opening only through orders (which are binding offers to either buy *or* sell), and not through quotes (which can simultaneously indicate a willingness to buy or sell at different prices).

64. Where there is no opening trade for SPX Options during the settlement window on a settlement date for VIX Options and VIX Futures—and thus no price to incorporate into the SOQ and HOSS processes—the opening price is the average of an SPX Option's bid and ask price determined at the open at 8:30 a.m. At that time, CBOE executes SPX Options orders at market-clearing prices and removes all remaining unexecuted orders. The auction clearing prices for SPX Options expiring in exactly 30 days are then used as part of the calculations to settle VIX Options and VIX Futures expiring that calculation day.

65. Shortly after VIX Options were created, a new set of products arose. These allowed investors to purchase shares (in the case of exchange-traded funds, or "ETFs") or notes (in the case of exchange-traded notes, or "ETNs"), the value of which are directly linked to the value of the VIX or related products, such as VIX Futures. ETFs and ETNs—collectively referred to herein as electronically traded products, or "ETPs"—trade on a national securities exchange like a security.

FACTUAL ALLEGATIONS

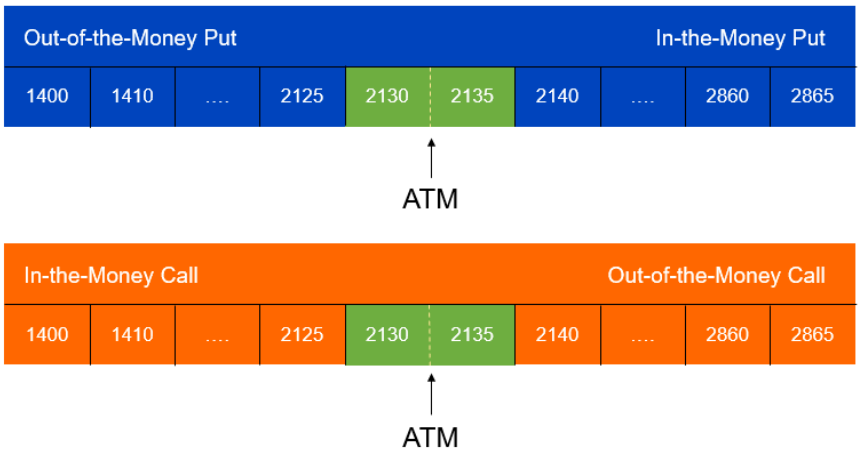
I. CBOE KNOWINGLY DESIGNED A FLAWED PRODUCT TO ENSURE THE CONTINUED SUPPORT OF A PRIVILEGED CLASS OF CLIENTELE

A. To Attract and Keep Liquidity Providers, CBOE Made Its VIX Products Extremely "Replicable," Which Also Made Them Uniquely Susceptible to Manipulation

66. "Replication" is the ability to accumulate a portfolio of the components of an index in the same proportion that each component is represented in the index. The returns from such a portfolio should mimic those of the index, and the values of the two should converge at

final settlement. The ability to replicate is important, particularly for liquidity providers, because it allows for market participants to offset directional risk.[7] If a potential liquidity provider feels constrained in its ability to act as a counterparty because of a perceived inability to hedge its directional risk through replication, it would be less willing to serve in that capacity. The market would be less liquid, and retail or other volatility market investors would be less inclined to trade in VIX products because they would be less able to enter or exit positions when they wanted to (or at least less able to do so at the prices they wanted).

67. Prior to 2003, only four SPX Options series were used to calculate the published VIX figure. The following table depicts the SPX Options series that were used to calculate the VIX prior to 2003. There were a large number of options available in the market—below, puts in blue, calls in orange, with the placeholder "…." standing in for a large number of series between the at-the-money price and the last one available. But only the four series shaded in green were actually used in the VIX calculation.



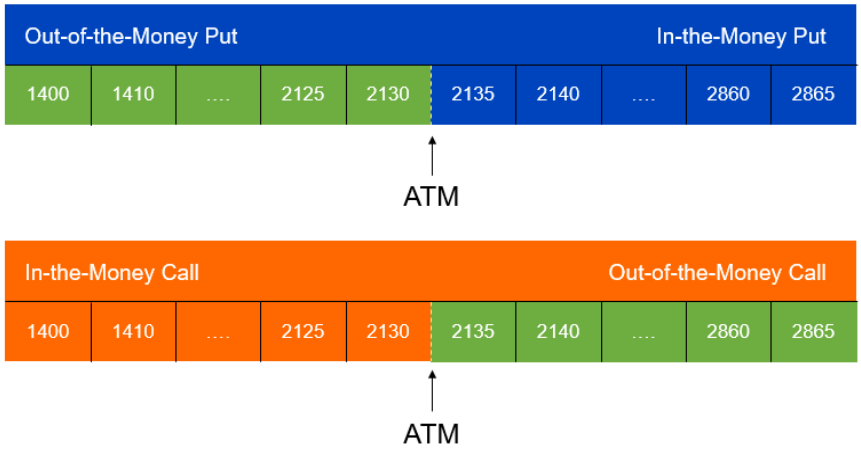
[7] An example would be an arbitrageur who trades (e.g., sells) the S&P 500 index futures against (e.g., buys) the basket of stocks which make up the S&P 500 index. That trader's goal is to make money by providing liquidity to other market participants and to offset the risk assumed in doing so in the opposing market. Once the trader has executed its arbitrage, it does not care if the market goes up or down, because losses from the futures transaction would be offset by gains from the basket of underlying stocks, or vice-versa.

68. Because they were so few in number, and at- or very close to being at-the-money, the four options series used as part of the older VIX calculation were the most liquid and costly options listed. This made it more expensive for a hypothetical liquidity provider[8] to replicate the VIX. The older VIX formula also presented another challenge to replication. Even though the formula was based on just four series, the at-the-money VIX price changed constantly as the equities market moved. As a result, it was not possible to tell *which* four options would be right-at-the-money at any given time. If the original VIX formula were used for settlement of VIX products, liquidity providers would have found it very expensive, if not impossible, to reliably "replicate" their VIX risk by trading in SPX Options.

69. As part of its efforts to monetize and then maintain the profitability of its VIX franchise, CBOE went to the opposite extreme. In 2003, it changed the VIX formula completely, and then used the new formula in the SOQ settlement process. It then refused to modify either calculation in any relevant way during the Class Period.

70. Specifically, CBOE greatly expanded the number of SPX Options series that factored into the VIX, and then used that same expanded set of inputs for the SOQ. The revised process took into account up to *one hundred and thirty* SPX Options series. After 2003, a chart similar to the above would look like this, again with the series shaded in green representing the series considered in the settlement calculation and the placeholder "…." standing in for a large number of options series:

[8] "Hypothetical" in that, before the implementation of VIX Futures and the change in the formula that came with them, there was nobody trading in "the VIX" and thus no need to replicate it.



71. CBOE made this change after consulting key market participants and being told that it needed to make the VIX "replicable." It was crucial for CBOE to attract and maintain sufficient market support for its VIX franchise, including particularly from large liquidity providers. By basing the SOQ process on a maximum of 130 SPX Options series, CBOE greatly increased the ability of liquidity providers to replicate the settlement value. This is because liquidity providers could replicate their risk with relative certainty, without knowing in advance what the exact at-the-money price would be at the moment of settlement. The relevance of the few options that happened to end up right at the money was now drowned out by the outsized impact from options liquidity providers knew would end up far in or out of the money.

72. CBOE's decision to prioritize replicability (and consequently, increased profitability) over preventing manipulation, is further shown by its other choices, each of which increased the risk of manipulation. CBOE designed the SOQ process such that (1) it did not conduct any averaging of the prices of the relevant trades (meaning the effects of any deliberate trading distortions were not smoothed out), (2) it occurred during a short time window (meaning a manipulator only had to trade in a way that moved prices for a short period of time), and (3) it gave particular weight to the cheapest kinds of trades (meaning a manipulator's most effective trading tool was also one of the cheapest).

73. To demonstrate how these changes impacted the ability to manipulate the VIX, Plaintiffs' economists twice measured the "deviation" of the monthly VIX settlement process. The deviation, which is calculated as the difference between the settlement price of VIX and the opening price of VIX just seconds later, is a measure of the artificiality of the VIX settlement. First, that measurement was calculated based on real-world trading data, from the real-world SOQ process. Then, it was calculated based on the same data, but using only the four original SPX Options series, not the hugely expanded SPX Options series from 2003 when CBOE decided to make the VIX much more replicable. This study found that the revised process created magnitudes of deviation *almost two hundred and fifty percent higher* than they would have been if the process had not been changed. This result is not just statistically significant, but remarkably so.[9]

74. A member of the CBOE team who designed the current VIX process has admitted that the decision to make the VIX "replicable"—i.e., to base it on the actual prices of underlying instruments that were tradable—was a flaw that exposed it to manipulation. In 2017, Timothy Klassen, one of the members of the Goldman Sachs team who assisted CBOE with the re-design of the VIX in 2003, gave a media interview. He there stated that: "trying to manipulate the VIX is not conceptually different from trying to manipulate any other index product that is dependent on underlying financial contracts or securities." He also said that the process CBOE adopted "almost certainly could [have] be[en] relatively easily improved."[10] But CBOE did not adopt any such "easy" improvements, because fixing the design flaw would reduce replicability and

[9] A two-tailed T-Test of these results produces a P-value of 2.0 *times* 10^{-7}.

[10] Elliot Blair Smith, *How S&P 500 Options May Be Used To Manipulate VIX 'Fear Gauge'*, MarketWatch (June 19, 2017), https://www.marketwatch.com/story/how-sp-500-options-may-be-used-to-manipulate-vix-fear-gauge-2017-06-19.

thus curtail CBOE profits and prevent the VIX franchise from taking off. Later, CBOE also feared that any alterations would similarly cause the products or market confidence in the product and the SOQ process to collapse. *See* Section III.E below.

75. Throughout the Class Period, CBOE catered to the liquidity providers, maintaining an extremely replicable system. And it did so despite knowing that such levels of replicability meant the SOQ settlement process and VIX products were put at an extreme risk of manipulation, and despite knowing that risk was in fact being routinely realized through the Doe Defendants' manipulative acts.[11] CBOE maintained this flawed system because the support of sophisticated liquidity providers was crucial to the success of the VIX franchise. CBOE was particularly incentivized to over-cater to the liquidity providers as it was attempting to get the VIX franchise off the ground. When a market is immature, it is not liquid and arbitrageurs have an even stronger need to be able to offset risk other than by trading in the same product.

B. Elevating Replicability, and Other CBOE Design Choices, Left the SOQ Process Vulnerable to Manipulation by "Banging the Close"

76. As discussed above, the VIX settlement process is dependent on the value of thinly traded, illiquid financial SPX Options. These SPX Options trade in far lower volumes than VIX Options and VIX Futures.[12]

77. This made it easier for the Doe Defendants to move prices in the direction they wanted, because trading even a small number of out-of-the-money SPX Options could result in

[11] CBOE's willingness to cater to a certain type of clientele is confirmed by other advantages it gave to try to ensure their support for its VIX franchise. For example, CBOE routinely paid market makers $125,000 per month to be liquidity providers, and was willing to offer them discounts on their trading fees.

[12] Indeed, the paper by Prof. Griffin and Mr. Shams, discussed more below, found that "the size of VIX futures with open interest at settlement is on average 5.7 times the size SPX options traded at settlement, and it is 7.3 times for VIX options that are in-the-money at settlement." Griffin, John M. and Shams, Amin, *Manipulation in the VIX?* (May 23, 2017), at 32, https://ssrn.com/abstract=2972979.

large differences in the settlement value of VIX Options and VIX Futures. This strategy is analogous to what is generally referred to in other markets as "banging the close."

78. The ability to manipulate was amplified because active trading in "strategy orders" for the relevant SPX Options must be submitted before 8:20 a.m. But CBOE only begins publishing information about the relevant SPX Options at 7:30 a.m. This meant that manipulators only needed to move the market in the intended direction shortly before 8:20 a.m. The short time window for manipulation was further intensified by the relatively infrequent nature of VIX settlements.[13] If CBOE had made the SOQ settlement window longer, during normal market hours, or based the measurement on a blended average of trades, manipulators would have had more difficulty reaping their ill-gotten gains.[14] CBOE knew (or at the very least recklessly disregarded) that these features of its SOQ process rendered it more susceptible to manipulation.

79. Because the VIX SOQ settlement process relied upon thinly traded instruments over a short time period, the Doe Defendants could and did engage in trading designed to move the cash settlement value for these instruments in a desired direction. Specifically, they could and did raise their bid premiums or lower their ask premiums for SPX Option puts at certain strike prices, knowing that those manipulated prices would be incorporated into the VIX SOQ settlement process.

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[13] On July 21, 2015, the SEC granted CBOEs request to commence weekly expiries of VIX Options. *See* Securities and Exchange Commission, *Release No. 34-75501*, https://www.sec.gov/rules /sro/cboe/2015/34-75501.pdf.

[14] The Doe Defendants had, among other things, cash-settled VIX Options and VIX Futures. By manipulating the SOQ process, the Doe Defendants were paid more (or were forced to pay less) than they would have otherwise. Such manipulated payouts were a major motivation for the manipulation, though not the only such motivation.

80. By placing higher bid premiums on puts at particular strike prices, the Doe Defendants were able to "bang up" the level of the mid premium for that strike (i.e., the mid-level between the bid and ask premium for a put at a given strike), and thus increase the settlement value for any corresponding VIX Option or VIX Future. Conversely, by placing lower ask premiums on puts at particular strike prices, the Doe Defendants were able to decrease or "bang down" the level of the mid premium for that strike, and thus decrease the settlement value for any corresponding VIX Option or VIX Future. Such actions could be magnified and made less risky for the manipulator where the prices are "spoofed," such as where an artificial bid or ask is given then withdrawn quickly once it has served its purpose (here, impacting the SOQ process). Traders could also cancel or delay the placement of bids or quotes until after the settlement process was complete in order to impact the settlement process.

81. A former CBOE employee responsible for designing the VIX has admitted publicly that including large numbers of cheap-but-heavily-weighted SPX put options allowed for manipulation. Specifically, in 2012, Matthew Shapiro, who was a member of the CBOE "Product Development Committee" in 2003 and 2004, gave an interview to Andrew Keene (who also was a CBOE employee and committee member in 2004). During that interview, Shapiro referred to activity during the SOQ process, and admitted that traders could "*crush the print*, they can come in and sell thousands and thousands of S&P options and drop that cash down," "or they can *bid the print up* and buy thousands of S&P options."[15]

82. In the words of Matt Levine (a former banker at Goldman Sachs and a former mergers and acquisitions lawyer at Wachtell, Lipton, Rosen & Katz), following the earlier design

[15] *KeeneOnTheMarket.com Weekly CBOE Volatility Index (.VIX) Interview w/ Matt Shapiro* (July 12, 2012), https://www.youtube.com/watch?v=lpeN_helJVY at 2:40.

changes in 2003, the VIX settlement process was an easy and tempting target for the Doe Defendants:

> [I]f you are a trader who owns a lot of the market in VIX futures, you could push around a large dollar value of futures by trading a small dollar value in options. This is particularly true because the S&P option volume is divided among many strikes, and the illiquid deep out-of-the-money S&P 500 options have a big influence on the VIX: You can move the price of those options a lot with relatively small trades, and those price changes have a disproportionate effect on the VIX. . . . [Thus,] if you are going to manipulate a tradable market . . . then VIX looks pretty tempting.[16]

C. Elevating Replicability, and Other CBOE Design Choices, Left the SOQ Process Vulnerable to Manipulation by Abuse of the Two-Zero Bid Rule

83. The SOQ calculation starts at the center and works outwards through increasingly out-of-the-money strike prices. This calculation stops when two zeroes are found in a row—the so-called "two-zero bid rule." The calculation stops at that point because that is supposed to be an indication that the any SPX Option series beyond the gap is so far out of the money that the pricing is likely too unreliable to use in the calculation.

84. The Doe Defendants could and did circumvent the two-zero bid rule by spreading bids out across strike prices. This was done to ensure that there were never two or more consecutive "zero bid" puts ahead of any strike prices that these Defendants wanted the SOQ process to take into account. With any gaps artificially bridged in this way, the SOQ calculation reached deeper and deeper into the range of out-of-the-money strike prices when determining the settlement value for the expiring VIX Options and VIX Futures.

85. The following table illustrates this strategy, and the way in which the Doe Defendants could achieve greater weighting from deep out-of-the-money puts in the SOQ process:

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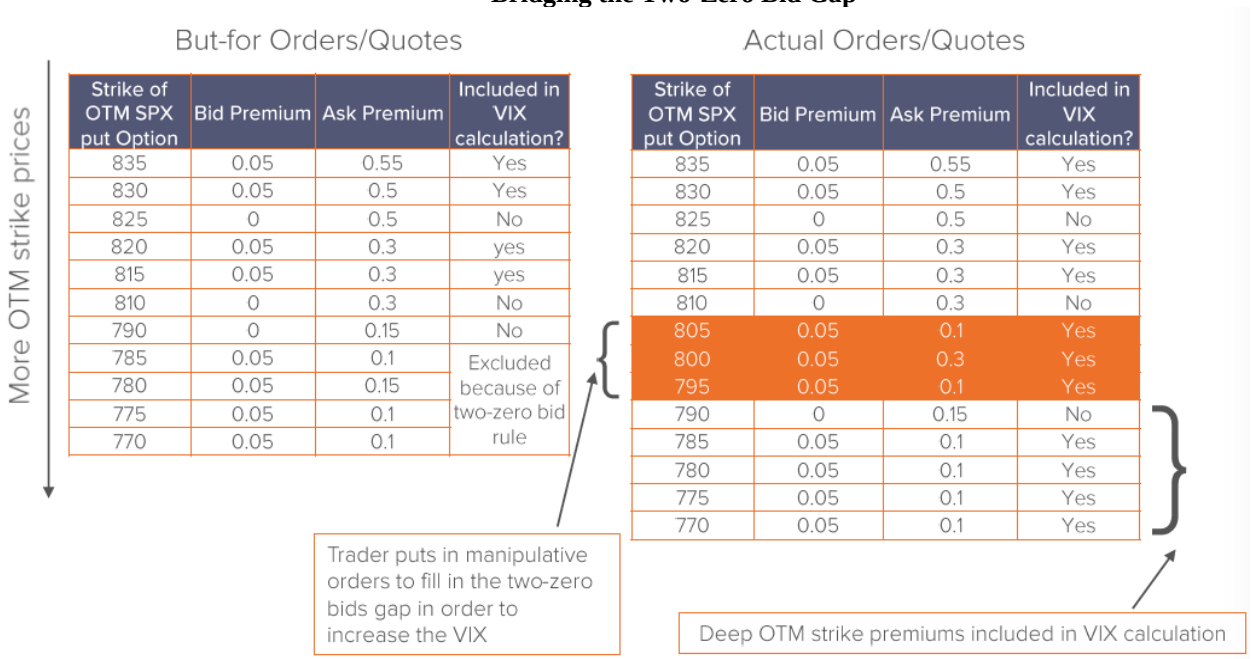
[16] Matt Levine, *VIX Trading, Hoaxes, and Blockchain* (May 24, 2017), https://www.bloomberg.com/view/articles/2017-05-24/vix-trading-hoaxes-and-blockchain.

Bridging the Two-Zero Bid Gap



86. The manipulative effect of such a scheme was magnified by the formula used by CBOE. The VIX is calculated using the following formula:

$$\sigma_1^2 = \frac{2}{T_1}\sum_i \frac{\Delta K_i}{K_i^2} e^{R_1 T_1} Q(K_i) - \frac{1}{T_1}\left[\frac{F_1}{K_0} - 1\right]^2$$

87. This formula shows a number of important relationships that influence how the VIX is set.[17] The term $Q(K_i)$ is the midpoint of the bid-ask spread for each option with strike K_i. The price of each K_i is weighted in the equation by the weight factor:

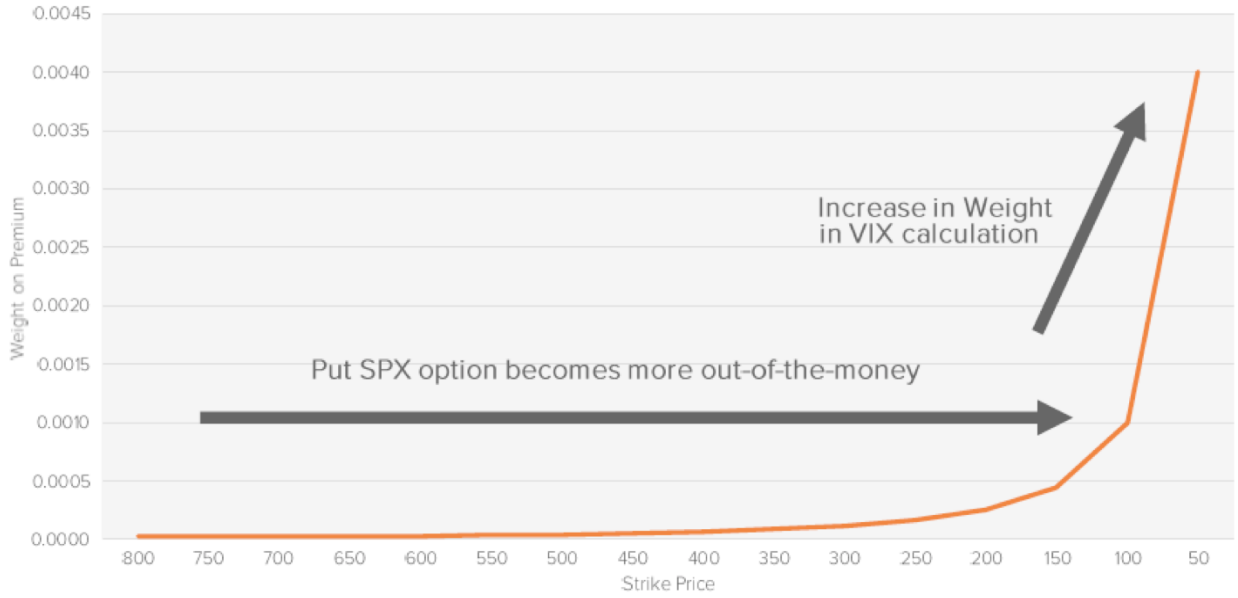
$$\frac{\Delta K_i}{K_i^2} e^{R_1 T_1}$$

[17] In this formula, in addition to the terms explained below, σ is VIX / 100; T is the time to expiration; F is the forward index level; K0 is the first strike price below the forward index level F; Ki is the strike price for the i-th out-of-the-money option (a call option if Ki > K0, a put option if Ki < K0, and a put and a call if Ki = K0); ΔKi is the interval between the strike prices (half the difference between the strike on either side of Ki); and R is the risk-free interest rate to expiration.

88. The size of this weighting factor therefore determines how much the pricing of a given strike will influence the VIX settlement value. First, consider ΔK_i, which is half the difference between the strike prices on either side of a given strike price K_i. This variable captures whether certain strikes were "skipped," and therefore trading across strike prices is more spread out. ΔK_i tends to be larger for the more out-of-the-money options. Second, consider K_i^2 which is the square of the strike price. If this term is smaller (has a smaller strike price), then the weighting factor will *increase*. For this reason, out-of-the-money put options (not call options) have a much greater impact on the ultimate VIX settlement price. This is because the strike prices of out-of-the-money put options are always *less* than the prevailing at-the-money price, while the strike prices of out-of-the-money call options are always *greater* than the prevailing at-the-money strike price.

89. Together, these factors mean that *the put options that are the most out of the money* will have a disproportionate impact on the ultimate VIX settlement price. This relationship is shown in the following figure. By avoiding the two-zero bid rule, and thus causing the calculation to reach into bids and asks that were *even deeper out of the money*, the Doe Defendants were able to amplify the impact of their manipulative acts. CBOE knew or recklessly disregarded that these features of its SOQ process rendered it more susceptible to manipulation for the sake of ensuring its VIX products were a profitable success.

Hypothetical Example: Moneyness of
SPX Put Option and Weight on Premium in VIX Calculation



II. MULTIPLE ANALYSES CONFIRM THE REPLICABILITY-DRIVEN DESIGN FLAWS WERE ROUTINELY EXPLOITED

90. Contrary to CBOE's repeated representations, and unbeknownst to investors, the VIX settlement process was being hijacked by the Doe Defendants so they could manipulate the cash settlement values for VIX Options and VIX Futures. And this hijacking was occurring, consistently, for *years*. Thus, far from accurately reflecting market volatility, the SOQ settlement process allowed the Doe Defendants to fool everyone else into accepting artificial settlement prices. While CBOE's proprietary settlement process for VIX Options and VIX Futures was complex, it was ripe for corruption by those with the necessary level of sophistication.

91. In May 2017, a research paper titled "Manipulation in the VIX?" by Professor Griffin and Mr. Shams of the University of Texas was first made available.[18] That paper concluded:

> First, at the exact time of monthly VIX settlement, highly statistically and economically significant trading volume spikes occur in the underlying SPX options. Second, the spike occurs only in the OTM [out-of-the-money] SPX options that are included in the VIX settlement calculation and not in the excluded in-the-money (ITM) SPX options. Third, there is no spike in volume for the similar S&P 100 Index (OEX) or SPDR S&P 500 ETF (SPY) options that are unconnected to volatility index derivatives. Fourth, if traders sought to manipulate the VIX settlement, they would want to move the prices by optimally spreading their trades across the SPX strikes and increasing the number of trades in the deep OTM put options consistent with the VIX formula. Trading volume at settlement follows this pattern, whereas normally deep OTM options are rarely traded. Fifth, there are certain options that have discontinuously higher weight in the VIX formula but are otherwise very similar to other options. These options exhibit jumps in trading volume at settlement that are not present at normal times.

92. The Griffin and Shams paper also considered alternative—purportedly innocent—explanations for these suspicious trading patterns. These included potential hedging (including by rolling hedging positions into SPX Options in a manner that exactly replicated the VIX weighting formula) or "pent-up liquidity demand."[19] Ultimately the paper rejected them all as inconsistent with the trading data, and instead concluded that "[t]he most natural explanation for these patterns appears to be attempted manipulation."[20]

93. On February 12, 2018, the law firm Zuckerman Law wrote to the SEC and the CFTC on behalf of a whistleblower "who has held senior positions at some of the largest investment firms in the world." The letter alleges that CBOE was responsible for allowing "pervasive flaw[s]" in the VIX; for failing "[to] implement circuit breakers on the VIX futures"

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[18] John M. Griffin & Amin Shams, *Manipulation in the VIX*? (May 23, 2017), https://ssrn.com/abstract=2972979. The paper was later peer-reviewed and published by the Oxford University Press.

[19] *Id.* at 3.

[20] *Id.* at 5.

for failing "[to] plac[e] any safeguards around an unstable market structure for VIX products"; and for providing "woefully inadequate" disclosure in light of those flaws and lack of safeguards. The letter also alleges that unknown "trading firms with sophisticated algorithms [capable of moving] the VIX up or down by simply posting quotes on S&P options" were actively manipulating in this way. As explained in the letter, "VIX is highly subject to manipulation by market participants with the ability to rapidly post quotes in the market for [SPX Options]" and "because the VIX is a theoretical index, which does not rely on trading activity but mid-prices, [it] can be moved up or down by posting quotes without any physical trading taking place."

94. Between these academic analyses, the whistleblower allegations, and public statements of multiple former public regulators (including by former CFTC Commissioner Chilton and Former SEC Chairman Pitt), a consensus has emerged that the SOQ process was severely compromised and was intentionally designed to feature the very vulnerabilities that the Doe Defendants exploited.

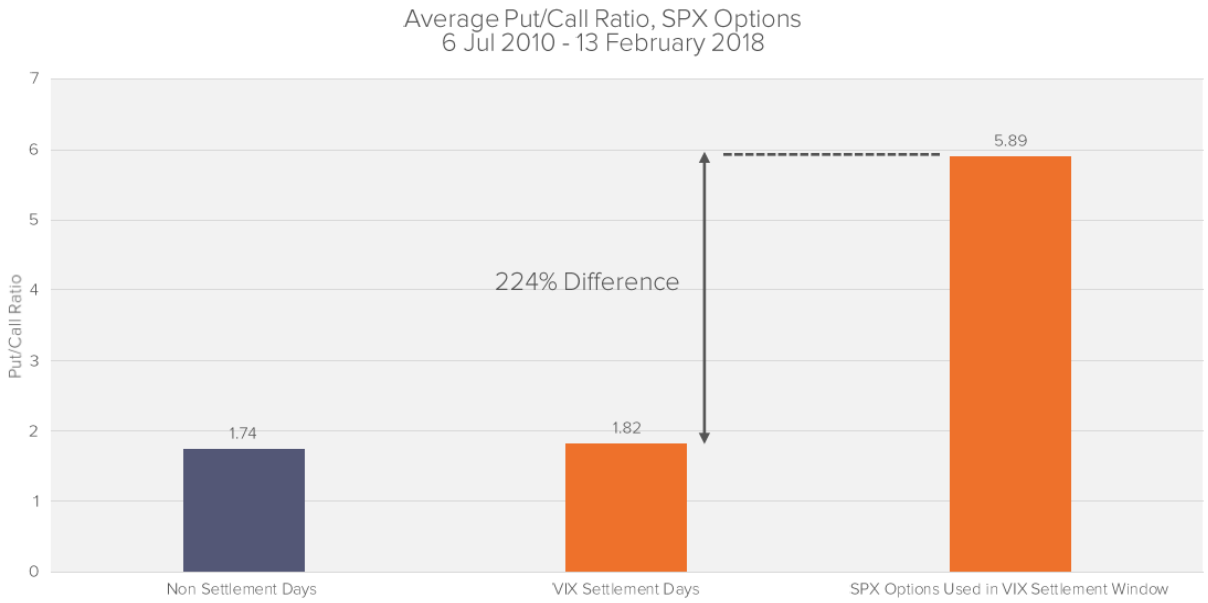
95. But members of the Class need not wait for the final results of any eventual government investigation. Plaintiffs' economists have conducted economic and statistical analyses demonstrating that the flaws in the VIX SOQ process were repeatedly and routinely exploited by the Doe Defendants. These "screens" are statistical tools based on economic models that use available data such as prices, bids, quotes, spreads, and volumes to identify the existence, causes, duration, and scope of manipulation, collusion, or other illegal behavior.[21]

[21] *See generally* Testimony of Rosa M. Abrantes-Metz on behalf of the Office of Enforcement Staff, Federal Energy Regulatory Commission (Sept. 22, 2014), http://elibrary.ferc.gov/idmws/doc_info.asp?document_id=14274590. For instance, the use of screens was part of the initial analysis that eventually led to the discovery of the LIBOR rate-

A. The Ratio of Trading Volume for SPX Option Puts to Calls Skewed Significantly on Settlement Days

96. SPX Option put trades have an outsized impact on the ultimate VIX settlement value. A disproportionate use of puts over calls thus provides evidence that manipulation was taking place. It indicates that market actors just so happened to prefer *the exact type of order* that would maximize a manipulative effect *during the exact time* such manipulative effect was possible.

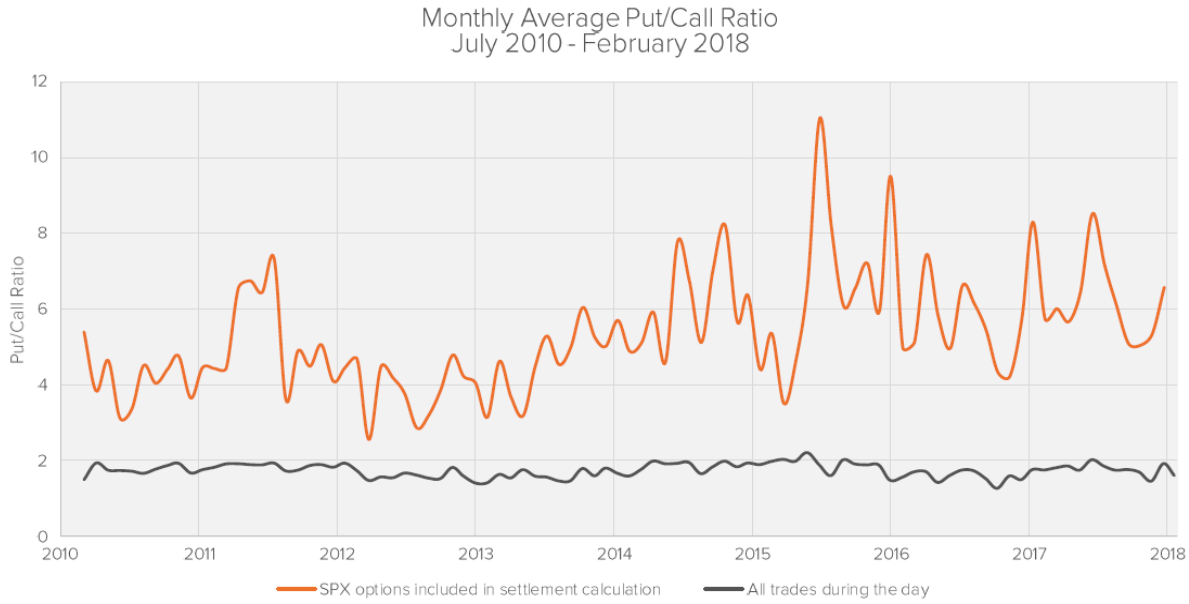
97. And this is precisely what the data show.[22] As seen in the following chart, the ratio of put trades to call trades was relatively similar (1.74 to 1.82) when considered across the whole of expiry and non-expiry days—but it ballooned (to 5.93) during the SOQ settlement window:



setting scandal. Screens also led to the initial detection, in the summer of 2013, of foreign exchange benchmark manipulation, which resulted in excess of $3 billion in first-round settlement payments by banks in the U.S., the U.K., and Switzerland in November 2014.

[22] Unless otherwise noted, all of the studies herein run as far back in time to the start of the Class Period as is possible based on the availability of sufficient data to run the analyses.

98. That the strongest tool for manipulation was heavily favored during the time of day when manipulation was most likely to occur can also be seen by tracking the trend over time. In the following chart, the blue-gray line represents the (lower) ratio of puts to calls overall, while the (higher) orange line does so for SPX Options included in the SOQ process.

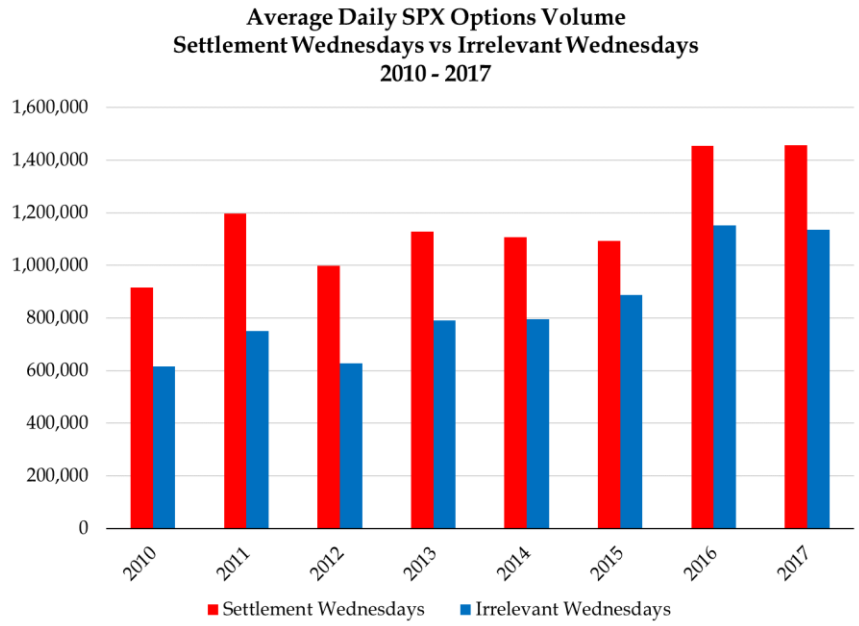


99. Again, the data show that market actors just so happened to prefer the type of order that would maximize a manipulative effect *during exactly the time* when such manipulative effect was possible. But the ratio was much different (closer to even) at times when a settlement was not occurring. The consistency of this result provides plausible evidence not just that manipulation was taking place. It also shows that CBOE—who watched, and also had undeniable access to the relevant data—knew about it, but did nothing, or recklessly disregarded it.

B. Trading Volume Increased in Multiple Suspicious Ways on Settlement Days, Particularly for SPX Options With a Bigger Impact on the SOQ Process

100. Multiple anomalies surrounding the *volume* of SPX Options trading on settlement days confirm that the flaws in the VIX SOQ process were routinely being exploited.

101. First, *trading volume generally was higher on settlement days than on non-settlement days.* If SPX Options were being used to manipulate the settlement process, one would expect there to be an abnormally high amount of SPX Options activity on settlement days, specifically. Again, that is exactly what the data show. Year after year, the red bars (volume on settlement Wednesdays) are consistently higher than the blue bars (non-settlement Wednesdays).[23]



102. Rather than comparing volume on settlement Wednesdays to non-settlement Wednesdays, Plaintiffs also compared volume on settlement Wednesdays to the volume on *all*

[23] For the sake of clarity, certain studies herein, for purposes of efficiency, focused on data derived from monthly settlement processes, whereas others also included the broader set of data that included settlement of the weekly products.

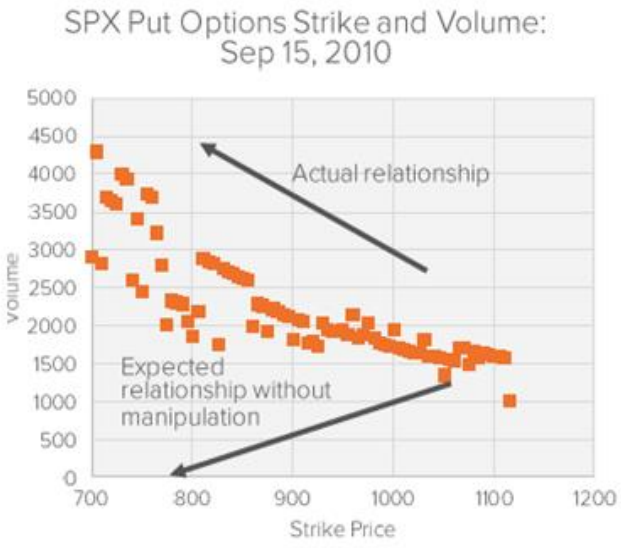
non-settlement days. The data there similarly show increased SPX Option trading volume on settlement days. Plaintiffs also compared the volume on settlement Wednesdays to the volume of the day *prior to* the settlement day. Again, the data show that SPX Options were traded more actively on settlement days. Indeed, 92% of monthly settlements prior to February 13, 2018, saw a higher trading volume than the Tuesday that preceded them.

103. The fact that trading activity spiked on settlement days was, itself, a red flag. But a closer inspection of the data CBOE had—specifically, an analysis of the types of transactions driving that settlement-day volume spike—provides even more compelling evidence that CBOE knew or recklessly disregarded that manipulation was occurring.

104. Second, *put options were traded more often on settlement days the more out-of-the-money they became*. All things being equal, in a market free of manipulation, one would expect that the trading volume would decrease the further out of the money an option becomes. When an option is less and less likely to be exercised, there is less and less reason for an investor to pay for it.

105. This expected relationship held true for SPX call options. This can be seen in the following chart, which depicts trading for SPX call options for September 15, 2010, within the SOQ window. For a call option, a higher strike price (more to the right in the chart) equates to being more out of the money. The expected relationship between moneyness and volume is thus seen in the chart below as a line running downhill from left to right, as the call option gets more out of the money. The more out of the money a call option is, the less likely it is to be traded. The actual trend follows that same line.

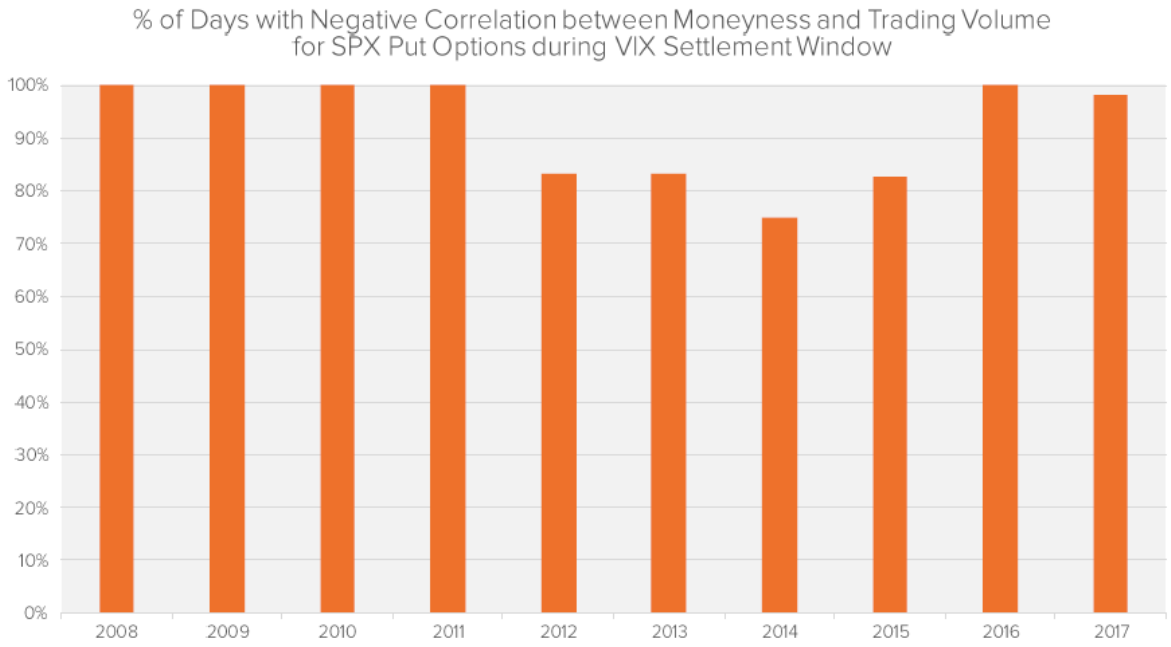
106. In contrast to SPX call options, SPX put options during the settlement process do *not* follow the pattern one would expect absent manipulation. The expected (absent manipulation) relationship between moneyness and volume is the same as with call options—lower volume for more out-of-the-money options. But for put options, a *higher* strike price (more to the right in the chart) equates to being less out of the money. Thus, the expected relationship between moneyness and volume appears in the chart below as a line running *uphill* from left to right, as the put option gets more out of the money.



107. The real difference from the previous chart is not that the expected line changes from uphill to downhill going from left to right, which is just due to the basic differences between a put and call. Rather, it is the fact that for put options the expected and actual lines are no longer one and the same, as they were for call options. The data instead show that, counterintuitively, the more out of the money an SPX put option was (the further to the left on the chart) the more it was being traded (the higher up on the chart).

108. The difference is explained by the fact that the weight assigned to the strike price for a SPX *put* option increases as the option is further and further out of the money. Thus, the fact trading volume unnaturally went up as the put options got more out of the money, but did not do so for call options, is further evidence that manipulation was occurring. The Doe Defendants traded far out-of-the-money puts because of their outsized impact on the SOQ process, not because of the normal forces of supply and demand.

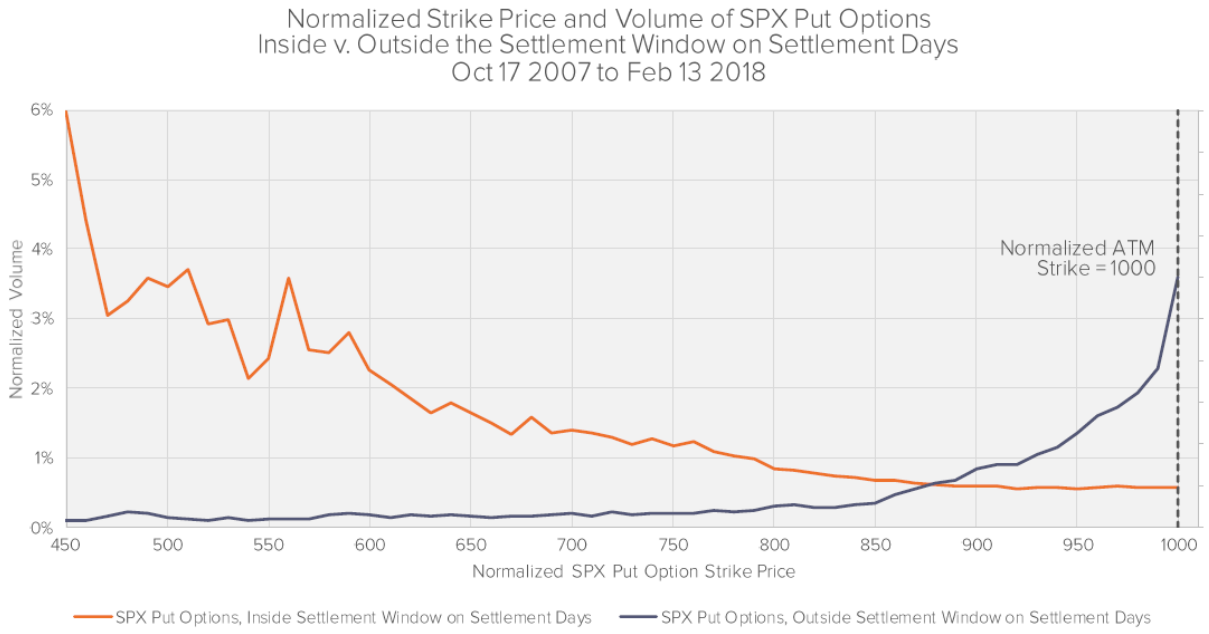
109. This breakdown of expectations was not isolated to September 15, 2010, which was just used as an example to illustrate the gap between expectations and reality. Rather, the break with expected patterns was seen on most *every* settlement day. As the chart below reflects, for many years, *every* settlement window saw SPX put options trading more often the further out they were.



110. To see the consistency of the problem another way, the following graph plots the normalized volume of trading for SPX Options both during the SOQ settlement window (orange line) and outside the settlement window (blue-gray line).

111. As with the one-day chart above for put options, a lower strike price is more out of the money. Thus, movement from left to right would be expected to result in an 'uphill' plot, with volume increasing as the strike price becomes less out of the money. This is what the data show for trading outside the settlement window, seen in the following chart as the gray-blue line.[24] In contrast, in the settlement window, the data show the opposite, with volume increasing the *more* out of the money the put option is. Once more, the data in CBOE's possession provide compelling evidence that SPX Options were not being traded for legitimate purposes, but to manipulate the settlement process.

[24] Due to the volume of data in tracking intra-day pricing information, for comparison purposes only data from January 7, 2015 to August 31, 2016 was used to construct the blue-gray line in this chart and for the one at paragraph 114 below.

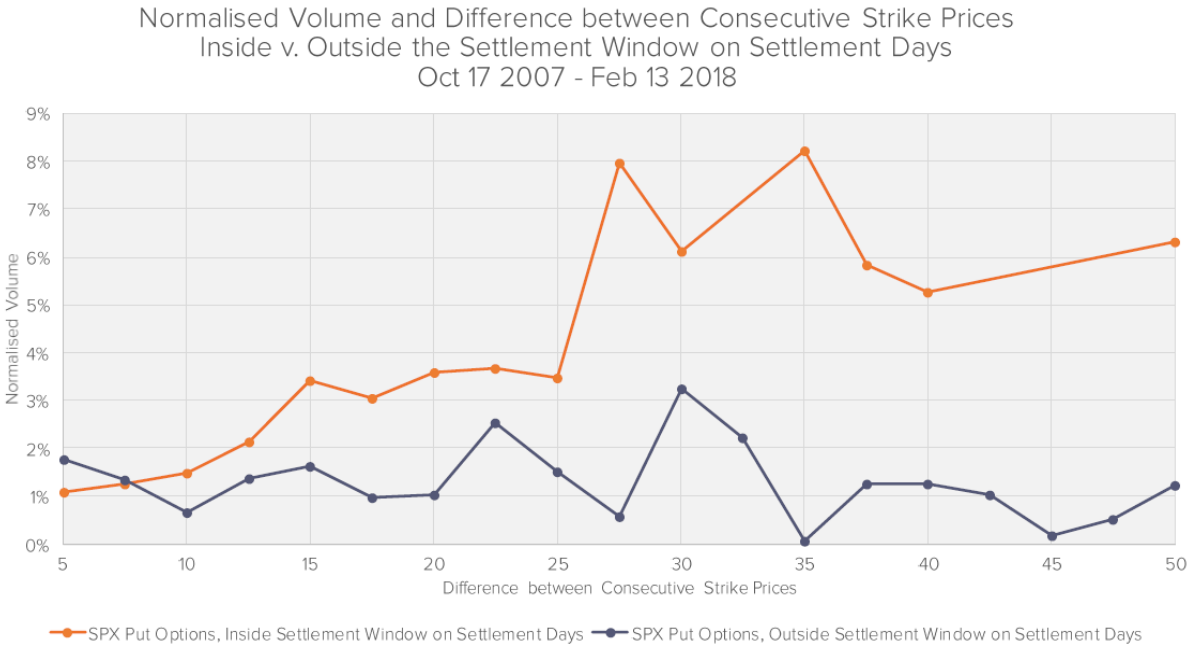


112. Third, *the abnormal volume of out-of-the-money option trades was particularly present in those options that carry the most weight in the SOQ formula*. As discussed in Section I.C above, ΔK_i is half the difference between the strike prices on either side of a given strike price K_i. This variable captures whether certain strikes were "skipped," and therefore whether trading across strike prices is more spread out. ΔK_i plays an important part in the VIX weighting formula. Strike prices that have a larger ΔK_i will have a larger impact on the ultimate VIX value.

113. Just as abnormal trading volume in puts (but not calls) is evidence of manipulation, an abnormal focus on strike prices with a larger ΔK_i is as well.

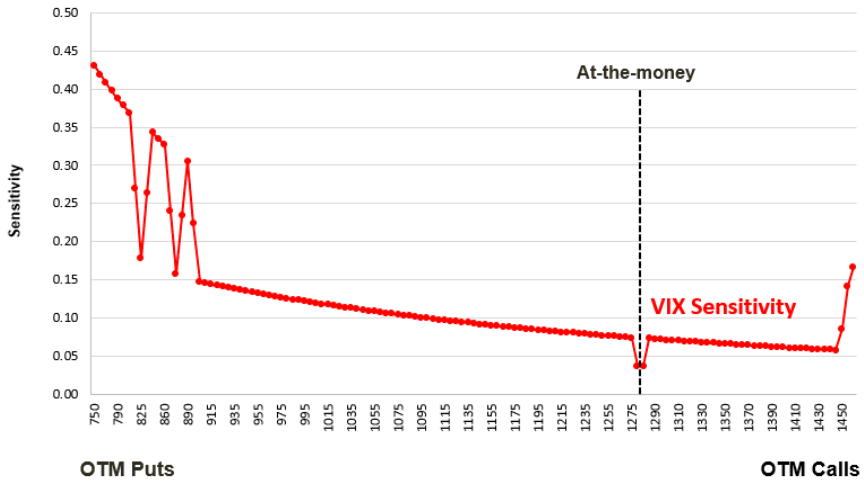
114. And that is what the data show. Trading volume was higher for options that had a wider gap between consecutive strike prices (i.e., had a higher ΔK_i). This is seen in the orange line, which rises (relative volume goes up) from left to right (as the gap between strike prices

grows). Notably, this was *not* true outside the settlement window, as seen by the blue-gray line.[25]



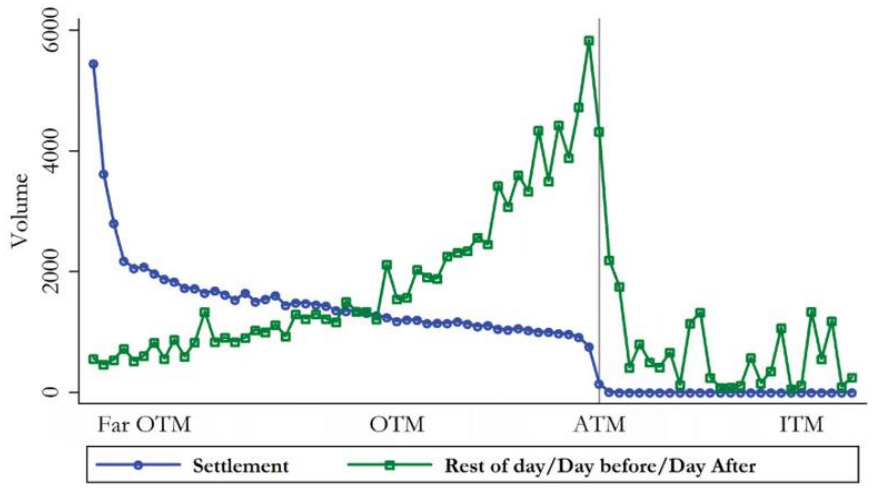
115. Similarly, the following chart again depicts the fact that the VIX SOQ formula after 2003 gave disproportionate weight to far out-of-the-money put options. The red line tracks the sensitivity of the VIX settlement price (on the y-axis) to trades in the various underlying SPX Option series inputs (on the x-axis) as they become more or less out of the money on the put and call sides. The far left and right sides of the chart—and especially the far left side—demonstrate that the VIX settlement value is more sensitive to deeply out-of-the-money puts than trades in other VIX options series.

[25] *See* footnote 24 above (discussing data used for blue-gray line).



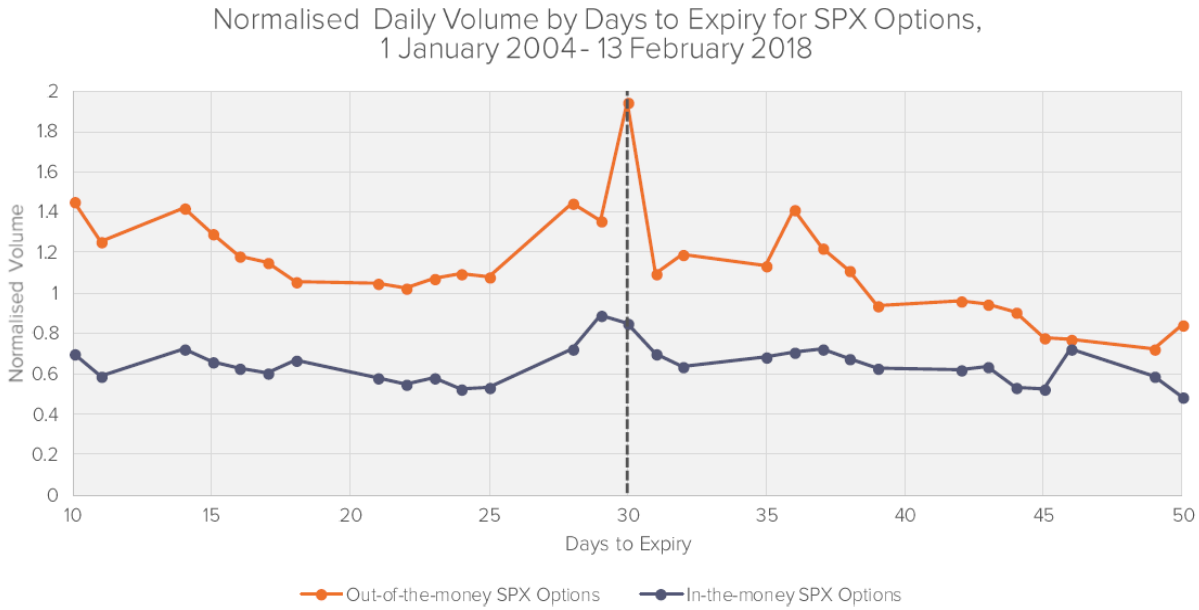
Source: Griffin and Shams (2018)

116. In the following chart, the blue line tracks the volume of trades in relation to the moneyness of the SPX Option series during the settlement window. One can see a long slope upward in volume as the SPX put options become further out-of-the-money. This continues until there is a sudden spike towards the end of the chart where the options are both the cheapest (because they are the most out of the money) yet have the greatest weight in the VIX SOQ formula. Notably, the shape of this curve mirrors almost exactly the shape of the curve in the sensitivity chart above. In contrast, the green line tracks trading volume *other* than during the SOQ window, and the curve of that line bears no relation to the VIX sensitivity curve. Instead, as one would expect with normal buying and selling, the largest amount of trading activity is centered around the at-the-money price because these are the options that are most likely to pay out upon settlement.

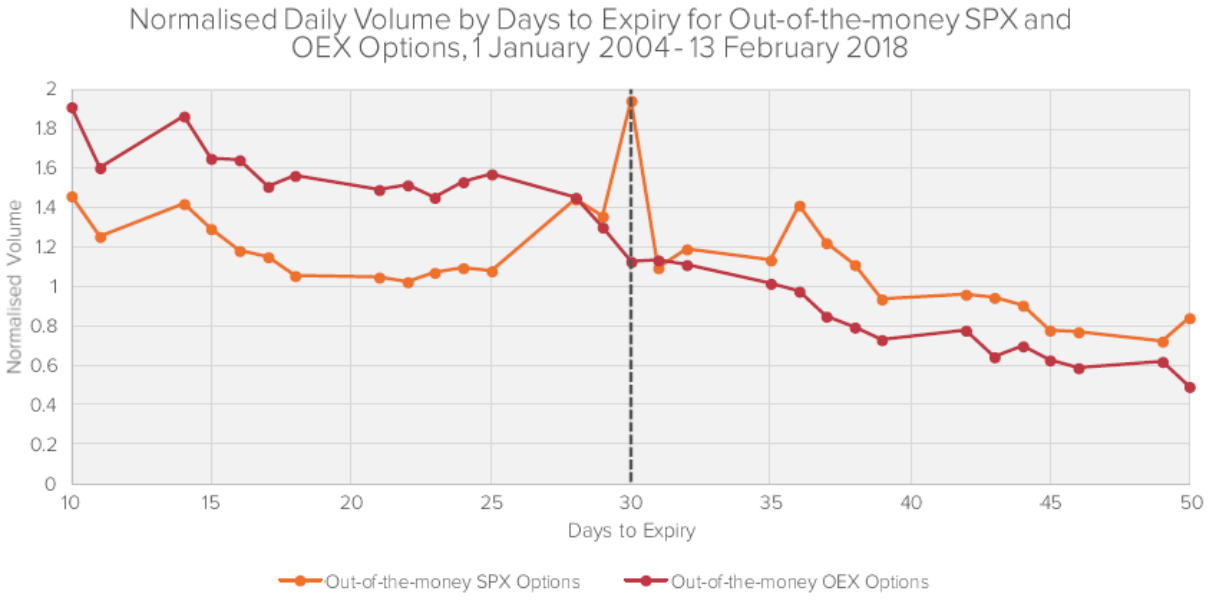


Source: Griffin and Shams (2018)

117. Finally, *trading volume increased right at the thirty day mark.* SPX Options were included in the VIX SOQ calculation only if they were (1) 30 days to maturity, and (2) out of the money. The data show that at exactly 30 days to maturity, out-of-the-money options—but *only* out-of-the-money options—saw a spike in trading volume. In other words, the increased trading volume on settlement days was driven by trading in the exact instruments that would impact the SOQ process.



118. Further confirming this conclusion, Plaintiffs compared out-of-the-money SPX Options to OEX options. OEX options are on the S&P 100 (rather than the S&P 500) and are not used in the SOQ process. As can be seen in the following chart, there is a spike in SPX Options (orange line) but no similar spoke in OEX options (red line).



119. Thus, again, the data show that the tools traders could use to manipulate the SOQ process were used in abnormal volumes. On the other hand, traders paid no special attention to transactions that are irrelevant to the SOQ process. This all suggests plausibly that the SOQ process was being manipulated. As CBOE had this data and far more, it also shows that CBOE knew or recklessly disregarded that was the case.

C. The Data Show Routine Exploitation of the Two-Zero Bid Rule

120. As discussed above in Section I.C, the settlement process was prone to manipulation because traders could artificially fill gaps in the SPX Options series taken into account in the SOQ process in order to avoid triggering the two-zero bid rule. Filling these gaps forces the SOQ formula to take into account SPX Options series with prices that were further and

further out of the money, which were cheaper and cheaper for the Doe Defendants to purchase for manipulation purposes. The data show this is exactly what was occurring.

121. Plaintiffs' economists studied all VIX-relevant SPX Options[26] and determined which ones would, given CBOE's criteria, be included in the VIX (and SOQ) formula. For instance, only options that are out of the money and have a non-zero bid are included. Plaintiffs analyzed how many SPX Options were quoted at 8:30 a.m. that were and were not "VIX-eligible," then did so again at 8:40 a.m.

122. Prior to February 2018, the *total* number of actively quoted SPX Options (meaning options with a non-zero ask quote) did not change much from 8:30 a.m. to 8:40 a.m. on settlement days. However, the number of those SPX Options that were *VIX-eligible* was higher, to a statistically significant degree, at 8:30 a.m. than at 8:40 a.m.

123. Prior to February 2018, the total number of actively quoted SPX Options did not change much from 8:30 a.m. on Tuesday to 8:30 a.m. on a settlement Wednesday. However, the number of those SPX Options that were VIX-eligible was higher, to a statistically significant degree, on the settlement day.

124. Plaintiffs' economists also analyzed whether there was a difference between the number of VIX-eligible options at 8:40 a.m. on a settlement day, and 8:40 a.m. on the day prior. There was no such difference, either for all actively quoted SPX Options or for the VIX-eligible subset of options.

[26] In the following analysis plaintiffs restrict their attention to SPX Options where were between 24 and 36 days from settlement. It is from this large group of options that the options used to determine the VIX are drawn. Note that VIX Settlement Dates are always 30 days before SPX Options settlement dates.

125. These three studies show that the Doe Defendants were filling gaps by trading more and more SPX Options. But they were doing so *only around the settlement window*. This shows an attempt to force the VIX SOQ calculation to include SPX Options that were further and further out of the money—options that had greater weight in the VIX SOQ calculation.

126. Another way to see this was to study the likelihood that any given SPX Option would meet the criteria for inclusion in the VIX SOQ calculation process (1) when the settlement calculation was conducted, versus (2) at another point in time. The data show that, in fact, a randomly chosen out-of-the-money, non-zero bid SPX Option is far more likely to be VIX-eligible at 8:30 a.m. on a settlement day, than at 8:30 a.m. the day prior. The only reason such an out-of-the-money, non-zero bid SPX Option would not be VIX-eligible is because it is excluded by the two-zero bid rule. This result holds because there were far fewer two-zero bid gaps during the settlement window. As with those previous studies, this is evidence the Doe Defendants were filling the two-zero bid gaps only when doing so mattered for the settlement calculation. Which is to say, it is evidence they were manipulating the settlement process.[27]

127. The data also show that the strength of the relationship between the presence of a settlement window, and the probability a given SPX Option would be VIX-eligible, *increases* as the option gains more weight in the SOQ VIX formula.[28] This is yet another sign that the gap-filling was done to manipulate the process.

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[27] As a robustness check, Plaintiffs also analyzed whether being VIX-eligible at 8:40 a.m. the day before was a good predictor of being VIX-eligible at 8:40 a.m. on a settlement day. It was not, again confirming it is the presence of the settlement process that drove the gaps to be filled.

[28] Here, the increased weight was because of a higher ratio of the midpoint price to the strike price.

D. Comparisons to the VIX Itself Reveal Further Evidence of Manipulation

128. The intraday VIX benchmark figure and the VIX SOQ settlement process use the same input in a nearly identical fashion. One would therefore expect that the settlement figure and the first intraday VIX benchmark figure to be almost always in sync.

129. The question here is not whether the VIX moves. It does, like most other prices. Rather, it is the comparison that is relevant. If the VIX moves differently when a settlement is involved, that would show that SPX Options—used for both the VIX figure itself and for the VIX SOQ process—were under unique pressures only around the settlement window. In other words, it would again show that the SOQ process was a target for manipulation.

130. Viewed from many angles, the data show the VIX acting differently around the settlement window. For instance: (1) VIX settlement values were statistically significantly different from the VIX opening values 65% of the time from May 2004 to February 13, 2018;[29] (2) there was a much larger gap between the VIX at the start and end of the day for settlement Wednesdays; (3) there was a much larger gap between the VIX at the start of the day and fifteen minutes later on settlement Wednesdays; and (4) the "coefficient of variation" for settlement Wednesdays was higher than for non-settlement Wednesdays as compared to either non-settlement Wednesdays or non-settlement days generally, meaning the VIX was not moving as smoothly on settlement days.[30] These differences were statistically significant.

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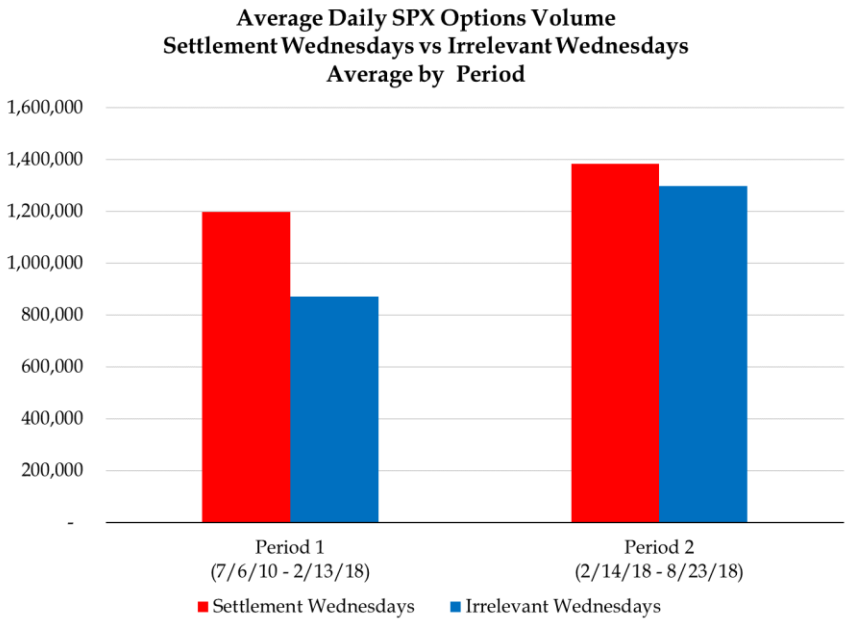
[29] This difference is not caused by the fact that the VIX index is based on a midpoint whereas the SOQ is based on actual trades. Across the many calculations that go into the SOQ, one would expect those differences in methodology to even out. Confirming that to be the case, the data show that the differences in traded prices versus the midpoint between the bid and offer prices is negligible (at the median, it is exactly zero).

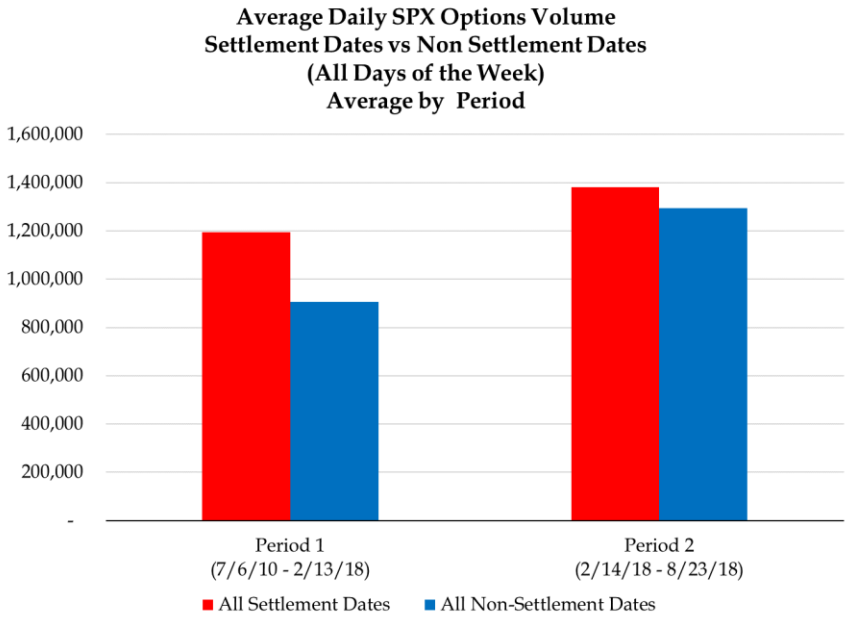
[30] The coefficient of variation in effect measures the amount of change from minute to minute during the course of the day.

131. All these studies show that the VIX was not behaving the same on settlement days as compared to non-settlement days—further supporting the conclusion that prices on settlement days were being made artificial by manipulation during the SOQ process.

E. Trading Behaviors Changed After It Was Reported That FINRA Was Investigating the VIX

132. On February 13, 2018, it was first publicly reported that the government—FINRA, specifically—was investigating the manipulation of VIX pricing. If the market is acting one way prior to a major event like the public announcement of FINRA's involvement, and a different way after that announcement, such change in activity is consistent with a lessening of the abuses out of an increased fear of getting caught. That is, again, what the data show. The following charts compare the volume of SPX Options trading on settlement Wednesdays with that on other days. The change in behavior can be seen in the bigger difference between the red and blue bars on the left (pre-February 2018) as compared to the difference between the red and blue bars on the right (post-February 2018).





133. Another indication that the Doe Defendants banged the close less often is that, after February 13, 2018, volume on settlement Wednesdays was higher than on the day before only about 57% of the time—which was (1) far less than the 92% prior to February 13, 2018, and (2) almost exactly in line with the 56% of times seen in the 'control' study, which looked at changes in volume between Tuesday and *non-settlement* Wednesdays.

134. Looking only at changes in volume for the most illiquid SPX Options again finds a difference before and after FINRA's investigation was announced. Prior to FINRA's announcement, there was a statistically significant difference in volume between settlement Wednesdays and non-settlement Wednesdays for the most out-of-the-money SPX Options.[31] Following FINRA's announcement, there is no longer a statistically significant difference in volume.

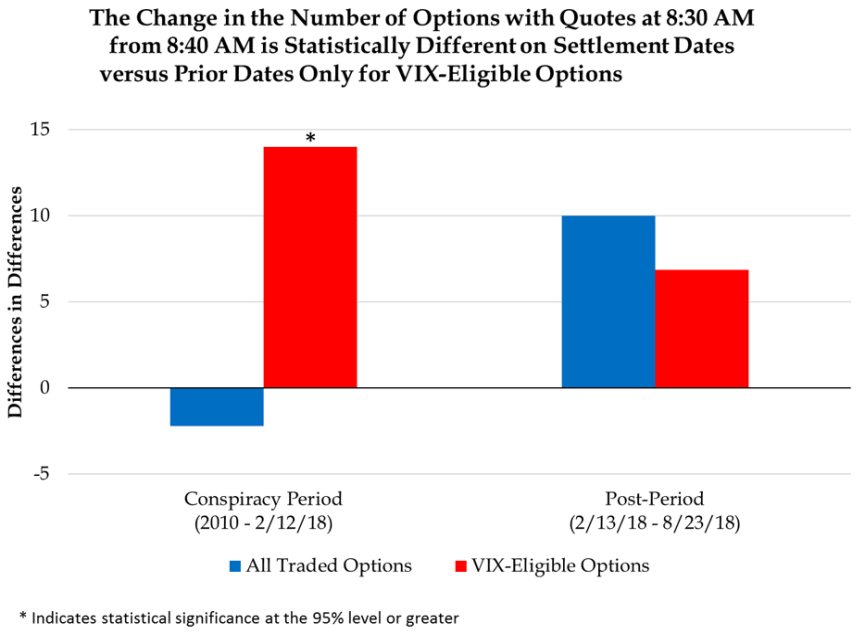
[31] As discussed above, the deeper out-of-the-money put options are the stronger tools for manipulation.

135. As discussed above in Section II.C, the evidence shows that the Doe Defendants were filling pricing gaps in order to avoid triggering the two-zero bid rule. The evidence further show this phenomenon occurred *only* in the settlement window. After February 13, 2018, however, these signs of manipulation abated.

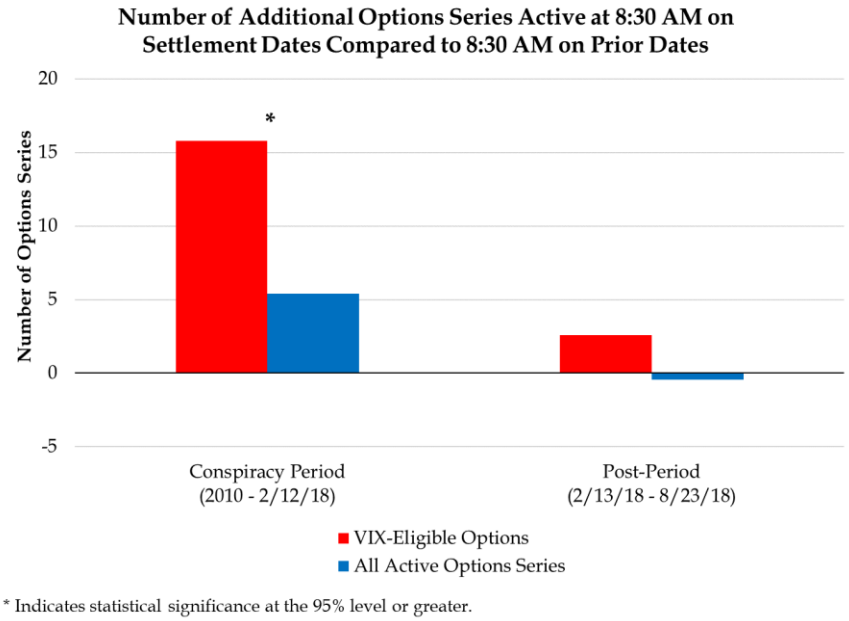
136. In the following chart, the small blue bar on the far left shows that, prior to February 13, 2018, the total number of actively quoted SPX Options 24 to 36 days from settlement did not change much from 8:30 a.m. to 8:40 a.m. The taller red chart next to it, however, indicates that the number of *VIX-eligible* (e.g., gaps-filled) SPX Options was different, to a statistically significant degree, between 8:30 a.m. and 8:40 a.m.

137. This is evidence of manipulating prices at 8:30 a.m. to fill the gap during the settlement process, then ceasing to support such artificial prices after the settlement process was complete. As seen in the blue and red bars on the right side of the chart, after FINRA's investigation was announced, there was no statistically significant difference in the number of VIX-eligible (gaps-filled) SPX Options around the settlement window. This is consistent with a slow-down in the efforts to artificially fill the gaps during the settlement window.[32]

[32] For this and the following chart, the time period is limited due to data availability.



138. The above analysis identified the presence of gap-filling strategies by looking at the difference between 8:30 a.m. and 8:40 a.m. on settlement Wednesdays. The following chart does the same analysis, but instead compares 8:30 a.m. on Tuesday to 8:30 a.m. on a settlement Wednesday. The conclusion is the same. Prior to FINRA's investigation, there was a statistically significant indication that pricing gaps were being filled only around the settlement window. After its investigation was announced, there was not.



139. Finally, as discussed above in Section II.D, multiple analyses of the behavior of the VIX itself on and around settlement days show that SPX Options (underlying both the VIX index and the VIX SOQ process) were under unique pressure on settlement days. Belying any claim this was benign, these signs abated after FINRA's investigation was announced. For instance: (1) after February 13, 2018, there were far fewer instances of statistically significant gaps between the VIX opening price and the SOQ settlement price (32%, down from 64%); (2) the size of those gaps was smaller, to a statistically significant degree, after February 13, 2018; (3) the difference in "normalized" intraday prices on monthly settlement Wednesdays versus non-monthly settlement Wednesdays was much less pronounced after February 13, 2018 than it was before; (4) there was no statistically significant difference in the behavior of the VIX from the beginning of the day to the end on monthly settlement Wednesdays versus on other days after February 13, 2018;[33] and (5) there was no statistically significant difference in the behavior of

[33] This means that that on settlement Wednesdays prior to FINRA's investigation, the VIX opening was a much worse forecaster of the value at which the VIX was going to close on

the VIX from the beginning of the day to fifteen minutes later on monthly settlement Wednesdays versus on other days after February 13, 2018. These studies show that there was a force pushing VIX prices towards artificial levels (i.e., manipulation) in the earlier period, that was less present once the FINRA investigation was announced.

140. In sum, multiple analyses—volume, gap-filling, and intraday VIX comparisons—confirm the patterns of manipulation that existed for many years disappeared or were substantially reduced once FINRA's investigation was announced. This break in behavior confirms that the patterns were not the result of innocent trading activity, such as hedging or market-making. Rather, the patterns are evidence of the Doe Defendants' manipulations of the VIX SOQ process.

F. The Flaws in the VIX Design Are Confirmed by Comparison to Other Volatility Benchmark Designs

141. CBOE made a choice when it selected and then stuck by the SOQ process. As discussed below, other calculation options existed.[34] If CBOE had selected a different process, including by incorporating one or more of the safeguards seen in other products and industry standards, it would have made the VIX products less susceptible to manipulation. But it also would have made the VIX products much less attractive to market makers and liquidity

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the same day, than on non-settlement Wednesdays. But such a difference in the forecasting accuracy of the opening VIX price no longer existed after February 13, 2018

[34] CBOE has publicly confirmed that it was aware of this choice, yet chose the flawed VIX model. *See, e.g.*, Edward T. Tilly, CBOE Chairman and CEO, Cboe Global Markets Inc, *Bank of America Merrill Lynch Future of Financials Conference* (Nov. 15, 2017) ("We took a long time to establish a process to settle the [VIX] futures, right? So we had a number of different alternatives. One of which, CME is employing. And that is taking a weighted average of transactions over a certain period of time, over 4 exchanges and settling your future against those 4 different price points on other exchanges. We looked at it from a trader's perspective and we follow the model that was very successful for us in launching fixed futures. And that is at a moment in time when we settle the futures, you can replicate that exposure. In the case of VIX, it's with S&P 500 options.").

providers, and thus far less likely to succeed in a crowded marketplace and earn substantial profits for CBOE.

142. *Other volatility products.* The European equivalent of the VIX is the "Volatility Derivatives on Eurex Exchange," known as "VSTOXX." Like the VIX, VSTOXX is designed to reflect investor sentiment and overall economic uncertainty. It does this by measuring the 30-day implied volatility of the "EURO STOXX 50," an index of the fifty largest and most liquid European stocks.[35] However, unlike VIX, VSTOXX is calculated using a process that is far less susceptible to manipulation. In the words of France's financial markets regulator, the Autorité des Marchés Financiers ("AMF"), in a report published in April 2018 following the commencement of this litigation and other public scrutiny of the VIX process:[36]

> The final settlement price of the VSTOXX future is calculated based on the average of the prices of the VSTOXX index between 11:30am and 12. As the [VSTOXX] index is calculated every 15 seconds, 61 points are used in calculating the settlement price of the future (as opposed to a single point for the VIX). *Given the liquidity of Eurostoxx 50 options at this time of the day, it would thus appear much more difficult and costly to manipulate VSTOXX futures* [*than to manipulate VIX*].

143. In contrast to the designers of the VSTOXX, CBOE has decided that the VIX settlement value is *not* based on averages and is calculated during a *shorter* trading window, *outside* of ordinary market hours. CBOE has also decided that the VIX SOQ involves a much *smaller* number of price inputs and would—to a significant degree—be based on much *less liquid* price inputs. CBOE chose not to implement other features in establishing the SOQ

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[35] Eurex, *Volatility Derivatives on Eurex Exchange: VSTOXX*, https://www.eurexchange.com/exchange-en/products/vol/vstoxx.

[36] Caroline Le Moign & Franck Raillon, *Heightened Volatility In Early February 2018: The Impact of VIX Products* (Apr. 2018), Autorité des Marchés Financiers, at 22, https://www.amf-france.org/technique/multimedia?docId=workspace://SpacesStore/1b3ca6c2-149c-4ab9-8043-826e060c19e8_en_1.0_rendition (emphasis added).

process because it recognized that, while its process would be less susceptible to manipulation, it would be much less lucrative for CBOE.

144. As the AMF concluded, all of these design features combined to make the VIX "much [less] difficult and costly to manipulate" than the VSTOXX.[37] Indeed, as the AMF went on to note, VSTOXX is not the only European index that measures volatility in a similar way to VIX, yet it is more difficult and expensive—or even impossible—to manipulate:[38]

> In France, Euronext publishes an index that is similar to the VIX, the VCAC, for which the calculation method is identical to that of the VIX. *However, since the VCAC is not* [*based on*] *an underlying* [*series*] *of listed derivatives, a manipulation scheme on the VCAC index similar to the alleged VIX manipulation may thus be ruled out.*

145. CBOE could have significantly reduced manipulation in respect of the SOQ process by designing it to be more like the VSTOXX or the VCAC. To confirm this, Plaintiffs took the real-world VIX monthly settlement data from 7:45 a.m. to 8:15 a.m. for a three-year sample period, from April 2016 and May 2019. Plaintiffs then calculated the VIX settlement price, but using the VSTOXX design instead of the VIX design. That is, Plaintiffs (1) took a snapshot of the price for each SPX Option series every five seconds for a thirty-minute window centered around 8:00 a.m. during the SOQ period; (2) calculated the average of those prices for each series; and then (3) in line with the VSTOXX methodology, deemed that average to be what the SPX Option series prices would be, and thus what the VIX settlement price would be, for those settlement days.

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[37] While some manipulation of the CSTOXX has been alleged, it is not nearly on the same scale as alleged in this proceeding.

[38] Moign & Raillon, *Heightened Volatility In Early February 2018: The Impact of VIX Products* (Apr. 2018), at 23 (emphasis added).

146. The results allow for a comparison of both the frequency and size of the price deviation[39] as between: (1) the VIX settlement process as CBOE designed it, and (2) the VIX settlement process that CBOE *could* have designed. This comparison shows that deviations would have been both *less frequent* and *smaller in size*, to a statistically significant degree, under the VSTOXX design than they were under the actual VIX design. In fact, the average size of the VIX price deviation was *more than two and a half times larger* using the VIX design as opposed to the VSTOXX design.

147. This does not mean that CBOE perceived itself as having the option of such a system while still having the same chance of success getting its VIX franchise off the ground. The VIX products came first and thus had more headwinds to success—CBOE had to create essentially a *new* space for *tradable volatility-based* products in the market. Eurex, the exchange that later launched the VSTOXX, was also not operating under the same economic pressures as CBOE faced at the time.[40] Thus, the fact another company chose to *not* engage in a deceit while still in hindsight achieving some success, does not negate Plaintiffs' allegation that CBOE perceived its replicability and other choices laid out above as a worthwhile shortcut to quicker, bigger successes in its VIX franchise.

148. *Recognized principles.* The design CBOE chose for the VIX and the SOQ also falls far short when compared to the "Principles for Financial Benchmarks" published by the Board of the International Organization of Securities Commissions ("IOSCO"). These principles

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[39] As above, "deviation" here is measured as the difference between the price outcome of the SOQ process and the price of the VIX upon market opening.

[40] For example, by the time the VSTOXX was launched in April 2005, Eurex was already the largest futures exchange in the world (CBOE, by contrast, had total revenues of only $200 million in 2005). Eurex was also only one of several exchange companies owned by its parents Deutsche Borse and SIX Swiss Exchange and not a stand-alone company engaged in a race to go public like CBOE.

describe processes intended to ensure that benchmarks that will be free of manipulation.

CBOE's deliberate and conscious design of the VIX violates *multiple* IOSCO principles:

a. CBOE's VIX design breaches IOSCO Principle 3, which states that Benchmark Administrators should ensure "existing or potential conflicts of interest do not inappropriately influence Benchmark determinations." CBOE derives revenue from the trading activity that constitutes inputs to the benchmark as well as from trading activity that is connected to the benchmark.

b. CBOE's VIX design also violates IOSCO Principle 7(a), which states that data used to construct a benchmark should "be based on prices, rates, indices or values that have been formed by the competitive forces of supply and demand." The data used to construct the VIX settlement are drawn in large part from illiquid instruments that lack trading depth.

c. CBOE's VIX design also violates IOSCO Principle 7(b), which states that data used to construct a benchmark should "be anchored by observable transactions entered into at arm's length between buyers and sellers in the market for the Interest the Benchmark measures." The SOQ is not constructed from transactions in the highly liquid VIX market, but from transactions in an illiquid period of the SPX Options market, in a special process in which CBOE's self-appointed market makers have preferential trading powers.

149. CBOE also deliberately chose not to follow these principles out of crude self-interest. The entire point of the push to create the VIX franchise was to keep everything in-house to drive up fees from *proprietary* trades, meaning CBOE was trying to exploit rather than avoid conflicts of interest. Nor did CBOE want to have the SOQ process tied to a small number of liquid, expensive transactions; rather, it chose to expand the calculation to encourage liquidity provider support, as well as a much higher volume of settlement-related trading and thus higher fees. It essentially decided to knowingly prioritize profits over protecting its non-privileged customers from manipulation.

150. *Comparison to other benchmark products.* CBOE's design choices also sharply contrast with the ICE SWAP Rate, which was introduced on March 31, 2015, following government investigations into manipulation of what was previously known as the ISDAfix

benchmark. In contrast to the VIX, the ICE Swap Rate directly relies on highly liquid trading activity from a number of different swap trading platforms as assessed at 24 randomized points in time.[41] ICE's decision to make this change in an established product *after a major scandal* does not undermine the fact that CBOE sought to get a competitive advantage in making its settlement process highly replicable. It did so in an effort to get its entirely new VIX franchise off the ground, and then to keep its profits growing.

151. CBOE also chose to design the VIX in a way that caused it to *share* flaws with various oil benchmarks. United States and European regulators have long held concerns that such benchmarks were based on "incomplete information from unregulated, illiquid markets."[42] In particular, oil benchmark prices have "long been under fire from regulators" because the benchmark administrators operate in a shroud of secrecy while generating profit from selling gathered market information to subscribers. The relevant benchmarks are also often generated from submissions or reports, rather than from live trading activity. Similarly, the SPX Options market employed in the SOQ process (including especially the deep out-of-the-money SPX put options most heavily weighted in the SOQ process) is illiquid in the same way as the commodity markets that have been subject to scrutiny by the U.S. and E.U. regulators. CBOE is also subject to the same conflict of interest concerns raised in those markets—it stands to benefit from manipulative activity in the form of increased trading revenues both in the products being settled and in the product being used to manipulate.

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[41] ICE Benchmark Administration, *IOSCO Assessment Report*, https://www.theice.com/publicdocs/ISR_IOSCO_Principles.pdf.

[42] Economist Magazine, *Fixing the Fix* (Feb. 10, 2014), https://www.economist.com/news/finance-and-economics/21595943-european-union-wants-change-how-commodity-benchmarks-are-set-fixing-fix.

III. CBOE ENJOYED DIRECT AND SIGNIFICANT BENEFITS FROM THE DOE DEFENDANTS' MANIPULATION—SEPARATE AND IN ADDITION TO CBOE'S INCOME FROM LEGITIMATE VIX TRADING

152. CBOE's design, listing, and promotion of the flawed VIX franchise was driven by a desire to cater to liquidity providers so that the VIX franchise would have a better chance of getting off the ground and then continuing its upward trajectory. As discussed below, however, Plaintiffs have also conducted analyses which confirm CBOE did not merely profit generally from the existence and success of the VIX franchise; it profited specifically from the Doe Defendants' manipulation of those products.

A. CBOE Benefitted From a 753% Increase in Fees During the SOQ Window by Using the Changed Formula

153. CBOE charges fees on a per-transaction basis, regardless of the value of that transaction. Thus, CBOE earns higher profits on a larger number of less expensive out-of-the-money option trades, than it does on a smaller number of more expensive close-to-at-the-money option trades.

154. By changing the VIX and VIX SOQ formula to include dozens of cheaper option series—rather than just four expensive ones—CBOE significantly increased its profits during the settlement window. It did so because there were many more transactions occurring during the SOQ window.

155. To demonstrate the magnitude of this change, Plaintiffs took the total amount of money spent on SPX Options during the SOQ process from 2007 to 2018, and calculated the trading fees that CBOE earned from those trades. Plaintiffs then calculated the amount of trading fees CBOE *would* have earned if this same amount of money had been spent under the pre-2003 formula, when the SOQ was based on only four, expensive, SPX Options series.

156. This analysis found that CBOE earned 753% more in fees on SPX Options trades during the SOQ window for monthly settlements from 2007 to 2018 than it would have in the but-for world with the simpler, pre-2003 calculation.

B. CBOE Benefited from a 60% Increase in Trading Fees on Manipulation Days

157. Plaintiffs also performed a regression analysis to study the correlation between (1) SPX trade volume during the SOQ window, and (2) the degree of deviation demonstrated by the outcome of the SOQ process on a given day.

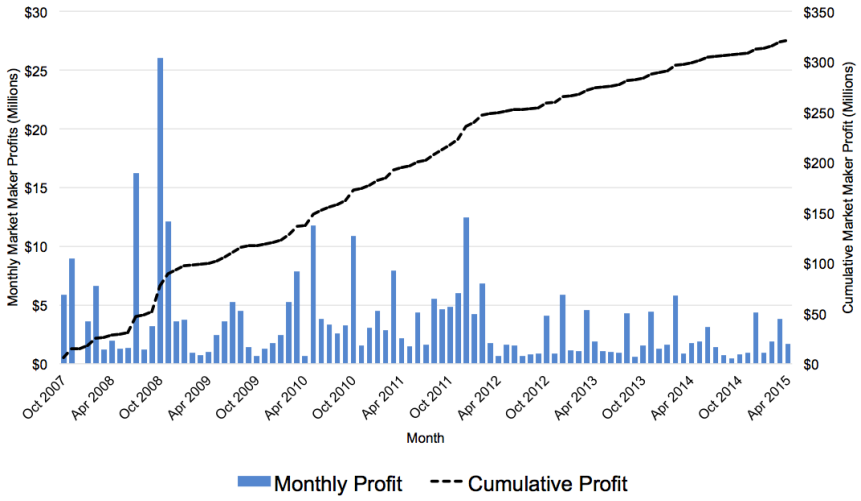
158. That regression demonstrated a statistically significant correlation between the two variables. The end result of this analysis found that there was on average a 60% higher trading volume on days that showed stronger signs of having been manipulated.

159. Because, again, CBOE earns per-transaction fees, this also means that on average CBOE was earning 60% more fees on manipulation days than on other days.

C. CBOE Earned Additional Profits on Still-More Transactions as the Risk from the Manipulative Transactions Was Laid Off

160. Even if the liquidity providers were not themselves manipulating, they could try to profit from the orders of Doe Defendants who were. This is because the liquidity providers were more than happy to take an order at an off-market price during the SOQ process, expecting to be able to largely arbitrage out of the position once the market opened.

161. The ability to make money off manipulation attempts *by others* provided another incentive for even honest liquidity providers to help get the VIX franchise off the ground. It thus was another way in which CBOE expected its design flaw would help lead to the VIX's adoption by critical market actors. For example, if someone traded on the deviation between the SOQ settlement result and the VIX at market open from October 2007 to April 2015, they would have made more than *$320 million*:



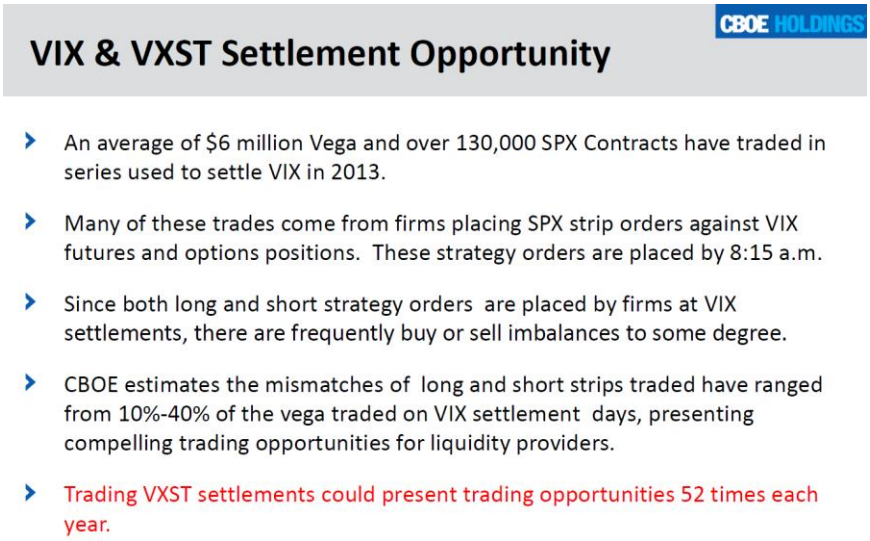
162. This is another example of how the flawed system was knowingly used to entice liquidity providers into supporting VIX products. It is also another example of how CBOE stood to benefit specifically from manipulation of the SOQ process and not just from the success of the VIX franchise overall. This is because every time a liquidity provider arbitraged out of a trade done with a Doe Defendant, the second transaction was itself another instance in which CBOE collected a per-transaction fee.

163. CBOE has long recognized that opportunities like these provided a strong incentive for market makers and other investors to trade the VIX products, and in fact encouraged certain privileged traders to profit in this way.

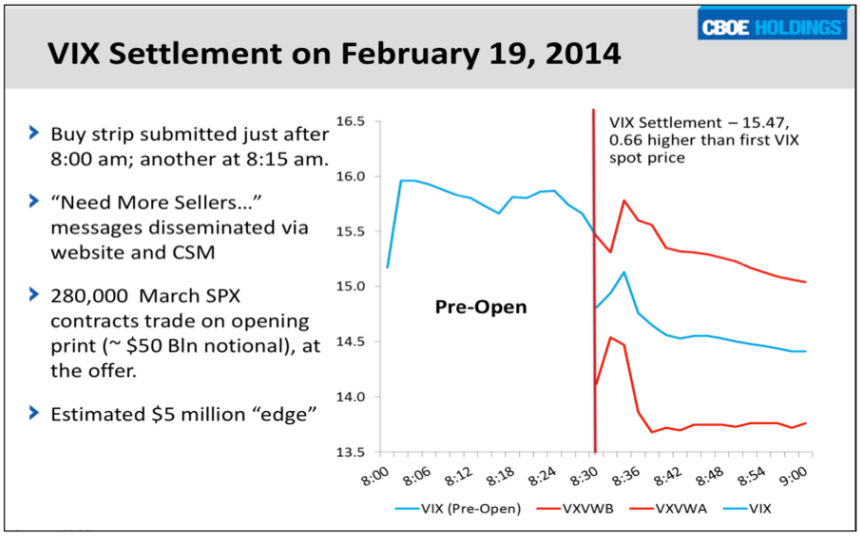
164. The following is a page from a presentation that CBOE gave to potential European retail investors in September 2014 as part of its ongoing promotion of the VIX franchise.[43] The first three bullets describe some of the trading patterns discussed herein, i.e., large strategic orders during the settlement process. The third and fourth bullets note how this

[43] CBOE Holding Presentation, *Contract design and Trading of VIX and Other Listed Volatility Derivatives*, CBOE RMS Europe Conference (Sept. 4, 2014).

creates "imbalances" and "mismatches" that (per the fifth bullet) present "opportunities" to make a quick profit *during all 52 weekly settlements a year*.



165. Indeed, in the same September 2014 presentation, CBOE provided its audience with a textbook example of the $5 million profit they could make (and thus the trading fees that CBOE would earn) by trading on the price deviation created by the SOQ process:



166. This kind of cynical self-promotion demonstrates CBOE was not merely aware that the SOQ process and VIX products were being manipulated, but was *actively seeking* to grow its profits as a result.

D. CBOE Reduced Its Costs and Increased Its Profits by Eliminating Human Safeguards Against SOQ Manipulation

167. In 2007, CBOE further automated the SOQ by eliminating the role of the "Order Book Official." This official was the only human watch-keeper of the SOQ process in real time.

168. Until 2007, the Order Book Official would observe the trades placed for SPX Options by the market makers and other market participants during the SOQ window. Where necessary, the Order Book Official could procure or reject trades from market participants, theoretically to help ensure that a given SPX options series was subject to a matched bid and offer at a reasonable market price.

169. The Order Book Official should have been doing this to ensure that no SPX Options series bid, offer, or trade was incorporated into the SOQ process at an unrealistic and off-market price. In so doing, the Order Book Official could have helped to ensure that the VIX process was not tainted by the fact that the VIX was based on actual bids, offers, and trades for tradeable instruments (rather than, say, just a weighted average of same), and thus could be directly corrupted by manipulation of those instruments.

170. Yet in 2007, CBOE eliminated the Order Book Official. This was part of a broader sweep to automate the VIX process, and thereby make the VIX products more profitable. By doing so, CBOE knowingly left the SOQ process even more vulnerable to manipulation.

171. Indeed, CBOE officials—including without limitation John Johnston (Vice President of Execution Services) and Phil Slocum (Executive Vice President of Trading Operations)—were warned that the removal of this safeguard exposed the SOQ process to the risk of being influenced by orders that were not reasonable and that did not reflect prevailing market conditions. These officials disregarded these warnings as part of their broader 'at-all-costs' push to increase CBOE profits.

E. CBOE Has Continued to Reap the Rewards of the Deliberately Flawed VIX Design, Because It Could Not Quietly "Fix" Those Flaws Once the VIX Products Proved Successful

172. As discussed above, the design flaws at issue here were consciously placed into the VIX products to ensure they quickly gained a foothold in the marketplace.

173. Even after the products took off, and CBOE saw that the flaws were, in fact, being routinely exploited, CBOE refused to change the SOQ process. It refused to do so because of the additional fees being generated as a result of the large volume of SOQ-related transactions. These included fees associated with manipulation attempts themselves *and* trades by counterparties to arbitrage out from those positions. They also included a 60% larger trading volume in general on manipulation days.

174. CBOE also refused to fix the process out of concern it would be viewed as admitting the VIX was flawed. Doing so could have derailed years of work, and threatened CBOE's planned IPO (discussed below) or later to crash CBOE's stock price. Emboldened by the success of its years of deceit, CBOE decided to simply maintain and conceal the status quo rather than bring unwanted attention to its design choices. CBOE also stuck with its flawed process both because its privileged customer base was profiting from the ability to manipulate, and because it wanted to avoid losing the prestige of publishing its figure alongside other opening-market figures.

F. The VIX Franchise Was Created as a Crown Jewel Product Ahead of an Anticipated IPO

175. As discussed in the introduction to Section III above, CBOE's drive to fully monetize the entire VIX franchise that was behind this fraud. CBOE benefitted tremendously by its decision to privilege liquidity providers by adopting an extreme replicability model.

176. It merits emphasis that the earlier of these (still ongoing) decisions were made when CBOE's executives were focused almost exclusively on growing CBOE's VIX franchise. CBOE was obsessed with turning itself into a for-profit enterprise and taking itself public. Multiple decisions were made to achieve these ends. These included the decisions, discussed in Section I above, to market aggressively "to the world that CBOE is a vital necessity," and to continually ignore repeated and consistent signs of manipulation.

177. CBOE was highly motivated to move towards an IPO. Indeed, CBOE executives had watched as the Chicago Mercantile Exchange ("CME") insiders profited handsomely when the CME went public in 2002, the first U.S. exchange to do so. The CME's initial public offering occurred in December 2002 at an initial offering price of $35 per share. But by February 2006 it was around $80 per share, and by mid-2007 it was over $100 per share. At the time of the IPO, the CME's officers and directors held over 1.5 million shares.

178. CBOE executives watched as the same thing happened with the Chicago Board of Trade ("CBOT"). CBOT was listed in October 2005, and stock was initially offered at $54.00 per share, but the stock soared to close at over $80 per share on the first day of trading.[44] By the end of October, shares were at $115, giving CBOT a market capitalization of more than $6 billion dollars.[45] At the time of the IPO, CBOT's officers and directors held almost half a million shares.

179. CBOE was itching to follow in these footsteps. But CBOE was delayed because of two hurdles: one legal and one economical.

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[44] *Shares of CBOT Rise 49% in Debut*, Los Angeles Times, (Oct. 20, 2005) available at https://www.latimes.com/archives/la-xpm-2005-oct-20-fi-wrap20.1-story.html.

[45] *A Not-So-Black Monday For CBOT,* Institutional Investor (Nov. 10, 2005) available at https://www.institutionalinvestor.com/article/b150nmxlxnn6qw/a-not-so-black-monday-for-cbot.

180. On the *legal* side, CBOE needed to resolve a long-standing governance issue with the members of CBOT. CBOE had originally been created by CBOT, and as a result all CBOT members had rights and privileges in respect of CBOE. As early as 2005, CBOE had formed a Business Model Task Force to help resolve the problem this presented in terms of turning the company into a for-profit, publicly-traded entity.

181. The Task Force held 12 formal meetings beginning in February 2005. On September 14, 2005, CBOE's board of directors adopted the Task Force's preliminary recommendations and directed CBOE's management to develop a detailed plan. Later that year, management reported on its progress. In January 2006, CBOE's board of directors adopted the creation of a Strategy and Implementation Task Force ("SITF"), which had still-more formal meetings and informal discussions.

182. All this culminated in the summer of 2006, when the SITF presented a set of recommendations as to how to de-mutualize CBOE—that is, to disentangle CBOE from its historic relationship with CBOT. Again, this was a necessary step in preparing to transition to a for-profit, publicly traded entity. A lawsuit was filed to try to stop the demutualization plan from going into effect. It was not until June 2008 that the lawsuit was resolved, and CBOE and CBOT reached an agreement on how to disentangle the parties.

183. In parallel with clearing this legal hurdle, CBOE faced *economic* challenges—it wanted to increase its revenues and profitability in order to maximize its IPO value. This presented a challenge for CBOE because of regulations implemented in the early 2000's that required brokers to direct their orders to venues that displayed the best prices. These regulations made it difficult for exchanges like CBOE to attract business for standardized products that were already available across multiple trading venues. CBOE's multiply listed options were losing

earning potential due to the expanding number of options exchanges, which have grown from five to fifteen. This made it important for CBOE to offer proprietary products which—unlike generic products that can and sometimes must be traded at other exchanges—are listed or traded at CBOE exclusively.

184. The best place for CBOE to mine for gold was through its exclusive licensing relationship with Standard & Poor's. This license already gave CBOE exclusive rights to list SPX Options.[46] Finding a way to increase interest in those options, as well as create a whole new line of products based upon them, was key to maintaining and increasing profits. This was true to such an extent that CBOE would eventually admit that losing CBOE's "exclusive licenses to list securities index options . . . granted to us by the owners of such indexes and based on which we have developed our proprietary VIX methodology" was one of its two chief business risks.[47]

185. What would become the VIX franchise was thus—if CBOE could make it succeed—a way for CBOE to secure business that could not migrate elsewhere. CBOE Chairman and CEO Edward T. Tilly confirmed the importance of the CBOE proprietary VIX Product offerings on an earnings call on February 8, 2017. He stated that "CBOE's proprietary index and volatility market data, it is a unique offering, much more value [sic] than our competitors because of primarily of the VIX and S&P." On the same call, CBOE's CFO Alan J.

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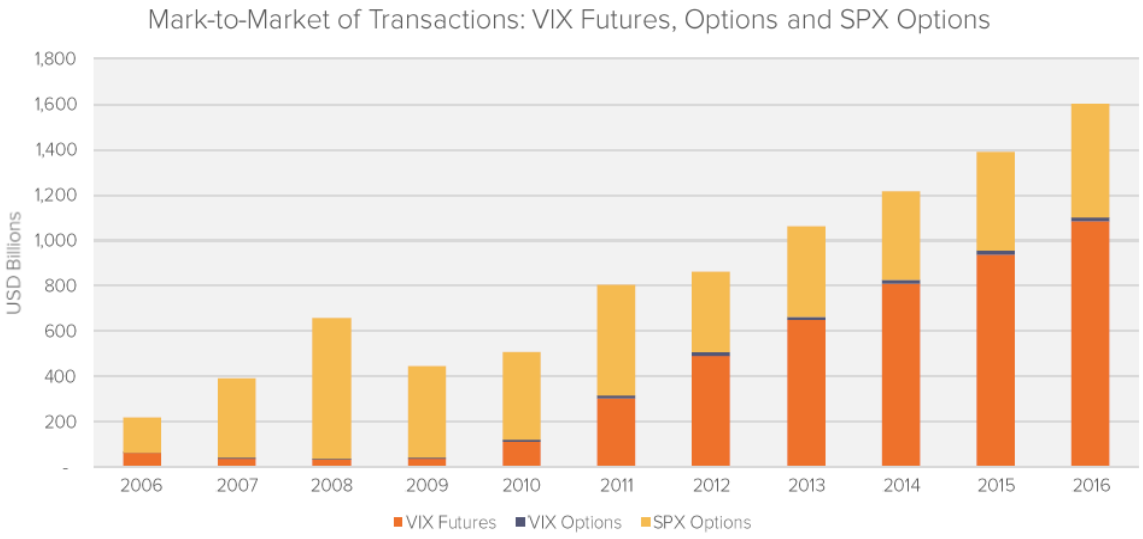
[46] "We have the *exclusive* right to offer options contracts on the S&P 500 Index and the S&P 100 Index as a result of a licensing arrangement with S&P OPCO LLC ("S&P) . . . . We are also authorized to use the S&P 500 Index and S&P 100 Index for *the creation of CBOE volatility indexes, such as the VIX Index, and tradable products on those volatility indexes.*" CBOE, Annual Report 2016, at 11 (emphasis added), https://www.cboe.com/framed/pdfframed?content=/aboutcboe/annualreportarchive/annual-report-2016.pdf&section=SEC_ABOUT_CBOE&title=CBOE+Annual+Report+2016.

[47] *Id.* at 3, 26.

Dean echoed these comments, adding: "I think there's a lot of opportunity, a lot of ways we can continue that growth from that VIX futures product which, as Ed said, was really designed for the options traders and has turned out to be a homerun."[48]

186. According to CBOE, VIX is "the premier benchmark for U.S. stock market volatility" and a "homerun" product.[49] CBOE's main website features the VIX ticker before any other. CBOE even named April 2018 as "VIX Month" to celebrate the 25th anniversary of VIX, claiming "[t]he growth of VIX and volatility trading has been an amazing story."[50]

187. As the following graph demonstrates, the market for VIX Options, VIX Futures, and SPX Options has increased significantly in recent years, ballooning from just over $200 billion in 2006 to $1.6 trillion in 2016:

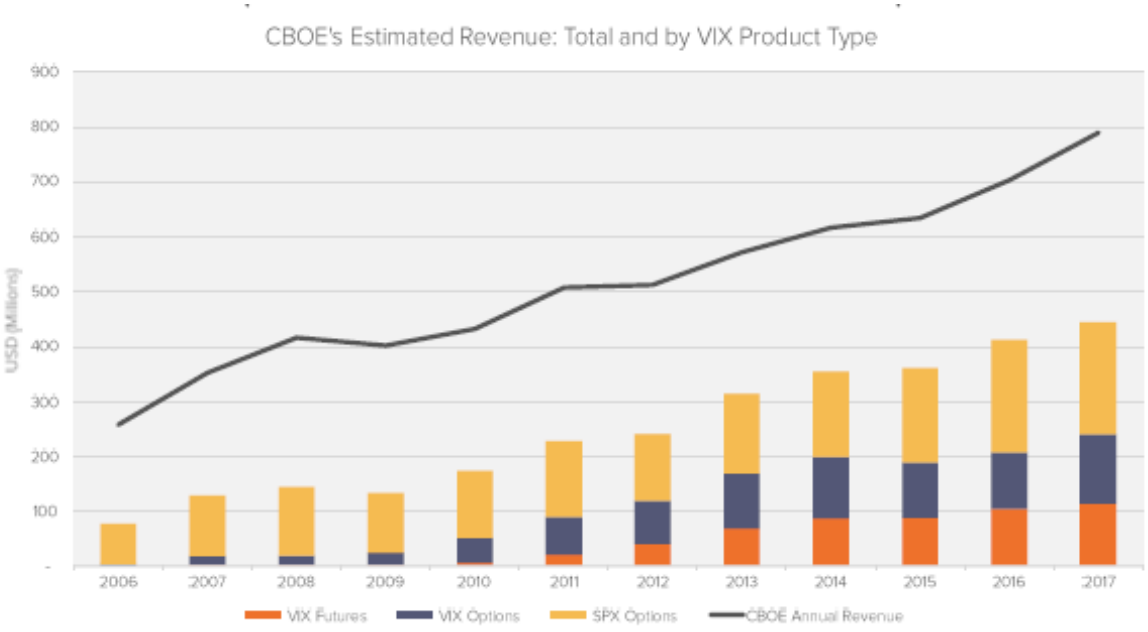


[48] *See* February 8, 2017 CBOE Holdings, Inc. Call Transcript, https://www.sec.gov/Archives/edgar/data/1374310/000110465917007806/a16-23690_24425.htm.

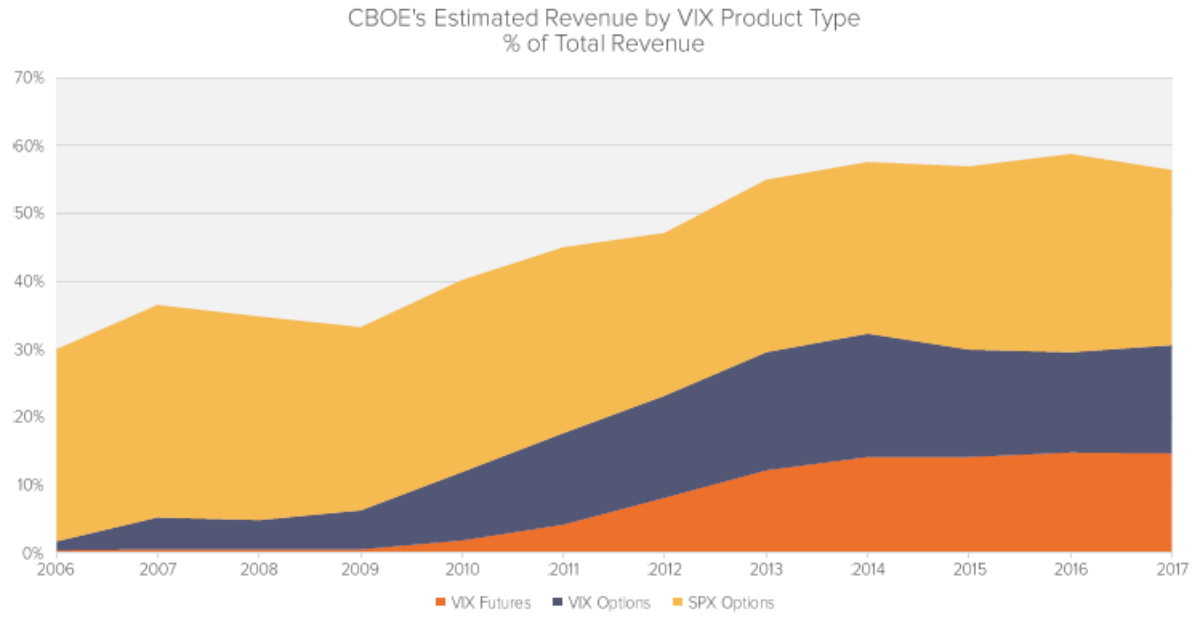
[49] *See* White Paper, CBOE Volatility Index—VIX, Chicago Board Options Exchange, at 2, http://www.cboe.com/micro/vix/vixwhite.pdf; CBOE Holdings, Inc., Form S-4 (filed Feb. 8, 2017), https://www.sec.gov/Archives/edgar/data/1374310/000110465917007806/a16-23690_24425.htm.

[50] *See* CBOE Blog, CBOE Declares April VIX Month (Apr. 6, 2018), http://www.cboe.com/blogs/options-hub/2018/04/06/cboe-declares-april-vix-month.

188. Because SPX Options, VIX Options, and VIX Futures are all proprietary to CBOE—and thus are traded exclusively on CBOE's exchanges—CBOE's revenues from the fees it collects on this trading have grown with the market. As a result, these three products are now "cash cows" for CBOE, collectively generating over $400 million dollars in annual revenue in 2017 and consistently representing about half of CBOE's total revenues:[51]



[51] For consistency of comparison, Plaintiffs have removed the effects of CBOE's unrelated acquisition of Bats Global Markets from the 2017 figures from the following two charts.



189. CBOE has celebrated and encouraged this growth. For example, it has declared that "2016 was our sixth consecutive year of record revenues and solid financial results, led by record index trading, with new all-time highs in trading volume for our S&P 500 (SPX) options and CBOE Volatility Index (VIX) futures."[52]

190. Trading fees on these products have led CBOE's revenue and profit streams in recent years, fueled by vigorous marketing and promotion by CBOE officials. CBOE had admitted that it is now "dependent" on these products for its continued success:

> In 2016, approximately 88.2% of our transaction fees were generated by our futures and index options, the overwhelming majority of which were generated by our exclusively-licensed products and products based on the VIX methodology. The bulk of this revenue is attributable to our S&P 500 Index options and VIX Index options and futures. *As a result, our operating revenues are dependent in large part on the exclusive licenses we hold for these products and our ability to maintain our exclusive VIX methodology.*[53]

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[52] CBOE, Annual Report 2016, at 7 (emphasis added), https://www.cboe.com/framed/pdfframed?content=/aboutcboe/annualreportarchive/annual-report-2016.pdf&section=SEC_ABOUT_CBOE&title=CBOE+Annual+Report+2016.

[53] *Id.*

191. On the back of this success, CBOE proceeded to its long-awaited IPO in June 2010. Those who recognized the potential of the VIX franchise in and around the IPO were not disappointed. CBOE's growing revenues from transaction fees also contributed to its growing stock price. From mid-2010 to mid-2018, CBOE's stock price increased over 300%.

192. An April 6, 2017 CBOE Notice of Proxy Meeting Statement reveals that CBOE's directors and officers collectively held over 2 million shares of CBOE common stock.[54]

G. CBOE's Decision to Knowingly Design, List, and Promote the Flawed VIX and VIX Products Is Part of CBOE's History of Prioritizing Its Profits Over Its Regulatory Responsibilities

193. This is not the first time CBOE wholly abandoned its regulatory role. To the contrary, CBOE has recently been sanctioned for similar bad-faith failures.

194. Specifically, in 2013, CBOE settled charges brought by the SEC by paying a penalty of $6 million and agreeing to "major remedial measures." These penalties were imposed after the SEC found that CBOE in 2008 and 2009 had failed to detect, investigate, and discipline naked short selling in violation of Regulation SHO by one of its member firms, optionsXpress, Inc. ("optionsXpress").

195. As the SEC put it, there is a conflict of interest "between the regulation of [an exchange's] members and [the exchange's] business interests," and "[t]his matter concerns the failure of a self-regulatory organization to police and control this conflict and prevent the advancement of its business interests, and the interests of its member firms, ahead of its regulatory obligations."[55]

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[54] *See* CBOE Holdings, Inc. Notice of Annual Meeting of Stockholders, http://ir.cboe.com/~/media/Files/ C/CBOE-IR-V2/documents/annual-proxy/2017-cboe-holdings-proxystatement.pdf.

[55] Release No. 69726, SEC (June 11, 2013), https://www.sec.gov/litigation/admin/2013/34-69726.pdf.

196. Specifically, the SEC found that "*CBOE put the interests of* [*optionsXpress*] *ahead of its regulatory obligations* by failing to properly investigate [optionsXpress's] compliance with Regulation SHO and then interfering with the SEC investigation of [optionsXpress]."[56] Indeed:

> not only did CBOE fail to adequately detect violations and investigate and discipline [optionsXpress], but it also took misguided and unprecedented steps to assist [optionsXpress] when it became the subject of an SEC investigation in December 2009. CBOE failed to provide information to SEC staff when requested, and went so far as to assist [optionsXpress] by providing information for its Wells submission to the SEC. *The CBOE actually edited* [*optionsXpress's*] *draft submission, and some of the information and edits provided by CBOE were inaccurate and misleading.*

197. More specifically, the SEC found:

> CBOE's failures were not mere oversights or technical violations, *but a systemic breakdown in several of its regulatory and compliance responsibilities as an exchange*. Not only did it fail to enforce the Commission's rules by not adequately investigating [optionsXpress's] compliance with Regulation SHO of the Exchange Act ("Reg. SHO"), CBOE's conduct also interfered with the Commission's Division of Enforcement ("Enforcement Division") staff's Reg. SHO investigation of [optionsXpress]. *This conduct was egregious.* CBOE assisted [optionsXpress] by taking the unprecedented step of providing information for, and edits to, the [optionsXpress's] Wells submission to the Commission—even more troubling, the information and edits provided by CBOE resulted in [optionsXpress] providing the Commission with inaccurate and misleading information. When questioned by Enforcement Division staff about the underlying matter, *CBOE failed to disclose that it had assisted* [*optionsXpress*] *with its Wells submission*. CBOE also failed to enforce Reg. SHO because it employed a Reg. SHO surveillance program that failed to detect a single violation, despite numerous red flags that its members engaged in violative conduct.
>
> *CBOE's failures cut across all aspects of its regulatory, business and exchange operations.* In addition to failing to adequately enforce the Commission's rules, *CBOE failed to adequately enforce its own rules*, including its firm quote and priority rules, as well as rules governing registration of persons associated with proprietary trading member firms. In addition, by making unauthorized "customer accommodations," rebates, and other credits to certain member firms

[56] Press Release No. 2013-107, SEC (June 11, 2013), https://www.sec.gov/news/press-release/2013-2013-107htm.

> and not others without an applicable rule in place that was consistent with the applicable statutory standards, CBOE failed to provide for the equitable allocation of fees and other charges and engaged in unfair discrimination between member firms. Furthermore, CBOE and C2 failed to file proposed rule changes or filed proposed rule changes long after, and in some instances years after, certain trading functions had been in effect. Lastly, CBOE failed to promptly furnish complete and accurate business records on a timely basis at Commission staff's request.

198. The SEC further found that "CBOE demonstrated an overall inability to enforce Reg. SHO with an ineffective surveillance program that failed to detect wrongdoing despite numerous red flags that its members were engaged in abusive short selling. CBOE also fell short in its regulatory and compliance responsibilities in several other areas during a four-year period."

199. Much of the misconduct described in the SEC's order occurred during 2009, further evidencing the fact that—as with manipulation of the VIX—CBOE was cutting corners and shirking its regulatory responsibilities as it sought to keep all of its customers (including its *manipulating* customers) happy and the VIX profitable.

IV. CBOE KNEW THAT THE FLAWS IN THE VIX AND VIX PRODUCTS WERE ROUTINELY BEING EXPLOITED

A. CBOE Had the Ways and Means Necessary to Know—and in Fact Knew—of the Manipulative Practices Described in this Complaint

200. CBOE established the methodology for calculating the VIX and the settlement values of VIX Options and VIX Futures. CBOE was solely responsible for actually calculating VIX settlement values, and for publishing the final settlement prices to the market. The prices, in turn, determined how much money market participants (including the Doe Defendants) gained or lost in holding VIX Options and VIX Futures on each settlement date.

201. As the administrator of SPX Options, VIX Options, VIX Futures, and the SOQ process, CBOE had a front-row seat for *every settlement*—it could see exactly who was doing what, when, and in what instruments. CBOE had access to all of the relevant data necessary to

reveal the fact that manipulators were rigging the settlement values. Indeed, in 2010 CBOE confirmed that it was monitoring the "bandwidth" (i.e., the volume of trades) used by its market makers and floor brokers each month in exchange for selling them the "permits" required to hold those positions. The more trades the market makers and brokers placed, the more CBOE charged them for their permits.[57] Through these or other similar monitoring capabilities, CBOE viewed the data on the relevant settlement dates in real-time as part of its SOQ process and therefore knew or recklessly disregarded that the Doe Defendants rigged the VIX settlement values.

202. Rather than disclosing the fact of manipulation, CBOE affirmatively and knowingly (or recklessly) published the wrong, manipulated prices to the market. Thus, independent of CBOE's misleading qualitative statements about the integrity of its VIX Options and VIX Futures, CBOE knew or recklessly disregarded the fact that its quantification of the VIX settlement value was materially misleading during the Class Period (defined below).

203. That the process has become more automated does not mean that CBOE was ignorant of the manipulations. It had the data to review and had committees and departments responsible for monitoring these products, such as the SPX Market Performance Committee, the Business Conduct Committee, the Department of Market Regulation, the SPX Floor Procedure Committee, the Risk Committee, and others. CBOE Vice President William Speth has represented that "our regulatory group actively surveils for potential VIX settlement

[57] CBOE Holdings, Inc. *Form S-1 Registration Statement, Registration No. 333-165393* (May 18, 2010) at 53 ("CBOE currently anticipates initially charging $3,750 per month for quoting and order entry bandwidth packets and $2,000 per month for order entry bandwidth packets and also plans to discount these fees by 20% through the end of 2010.") http://otp.investis.com/generic/sec/sec-show.aspx?Type=pdf&haspdf=1&cik=0001374310&FilingId=7267058.

manipulation."[58] CBOE's chief regulatory officer, Greg Hoogasian, assured the public that the CBOE "has a dedicated regulatory department that works with FINRA to monitor certain trading activity for our securities markets, including trading activity that could impact the VIX settlement."[59]

204. CBOE represented to the SEC and to the market, time and again, that it had in place surveillance to detect, and actively monitor for, violations of exchange trading rules. For example, in Forms 10-K throughout the relevant periods, CBOE reported in substantial form that:

> In order to ensure market integrity, we extensively regulate and monitor our Trading Permit Holders trading activities. Providing effective regulation is important for attracting and retaining the confidence and participation of market-makers, broker-dealers and institutional and retail investors. We expend considerable time, financial resources and effort to ensure that the exchanges' rules and regulations conform to regulatory 'best practices' within the securities exchange industry and within the regulatory regime overseen by the SEC, our primary regulator. In order to support our efforts and those of our market participants to comply with applicable law and our option exchange rules, we have developed our own automated market surveillance systems to monitor market activity on our option exchanges and across U.S. options markets.[60]

205. CBOE likewise touted: "Our exchanges are responsible for assessing the compliance of their TPHs with the respective exchange's rules and the applicable rules of the SEC and CFTC. The main activities that the exchanges, as applicable, are required to provide to measure compliance with these rules include . . . surveillance designed to detect violations of

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[58] Saqib Iqbal Ahmed & John McCrank, *Whistleblower alleges manipulation of Cboe volatility index*, Reuters (Feb. 13, 2018), https://uk.reuters.com/article/us-usa-stocks-volatility-manipulation/whistleblower-alleges-manipulation-of-cboe-volatility-index-idUKKBN1FX0ES.

[59] Elliot Blair Smith, *How S&P 500 options may be used to manipulate VIX 'fear gauge'*, MarketWatch (June 19, 2017), https://www.marketwatch.com/story/how-sp-500-options-may-be-used-to-manipulate-vix-fear-gauge-2017-06-19.

[60] *See* CBOE, Annual Report 2011.

exchange trading rules" and "surveillance designed to detect violations of other SEC and CFTC rules."[61]

206. In these and related disclosures, CBOE assured investors that, among other things, it could monitor and was monitoring the exact market activity alleged herein.

B. CBOE Knew the Doe Defendants Were Using Trading Techniques That *CBOE Itself* Publicly Recognized and Admitted Were Manipulative

207. CBOE has suspiciously decided to deploy enforcement efforts only against small players and in isolated fashion, and often only with respect to less strategically important products. However, even those actions belie any claim CBOE did not know of the Doe Defendants' manipulation. This is because Plaintiffs performed the same type of analyses CBOE has claimed to have done to help ferret out manipulation, but found far more instances suggestive of misconduct than CBOE has admitted.

208. Between July 2016 and January 2019, CBOE imposed small fines on three financial institutions for manipulating or attempting to manipulate products offered by CBOE. Notably, in each instance, CBOE waited until *years* after the relevant misconduct before making any public announcement.

209. On July 12, 2016, CBOE fined Morgan Stanley $750,000 for "[effecting EEM Option] transactions in a manner that failed to contribute to a fair and orderly market" in November 2012.[62] As evidence justifying the fine, CBOE pointed to an "order imbalance" created by an attempt to "replicate a portion of the Index Desk's expiring vega."

210. On December 21, 2017, CBOE fined DRW $1.5 million for disruptive trading of SPX Options and engaging in acts detrimental to the exchange from February 2014 through

[61] *See* CBOE, Annual Report 2016.

[62] CBOE Business Conduct Committee, *In the Matter of Morgan Stanley & Co. LLC.* (Jul. 12, 2016).

March 2015.[63] As evidence justifying the fine, CBOE pointed to "safety bids," as part of "strategy orders," being used to ensure "additional options series" were included in the settlement calculation—that is, DRW had attempted to bridge a two-zero bid gap.

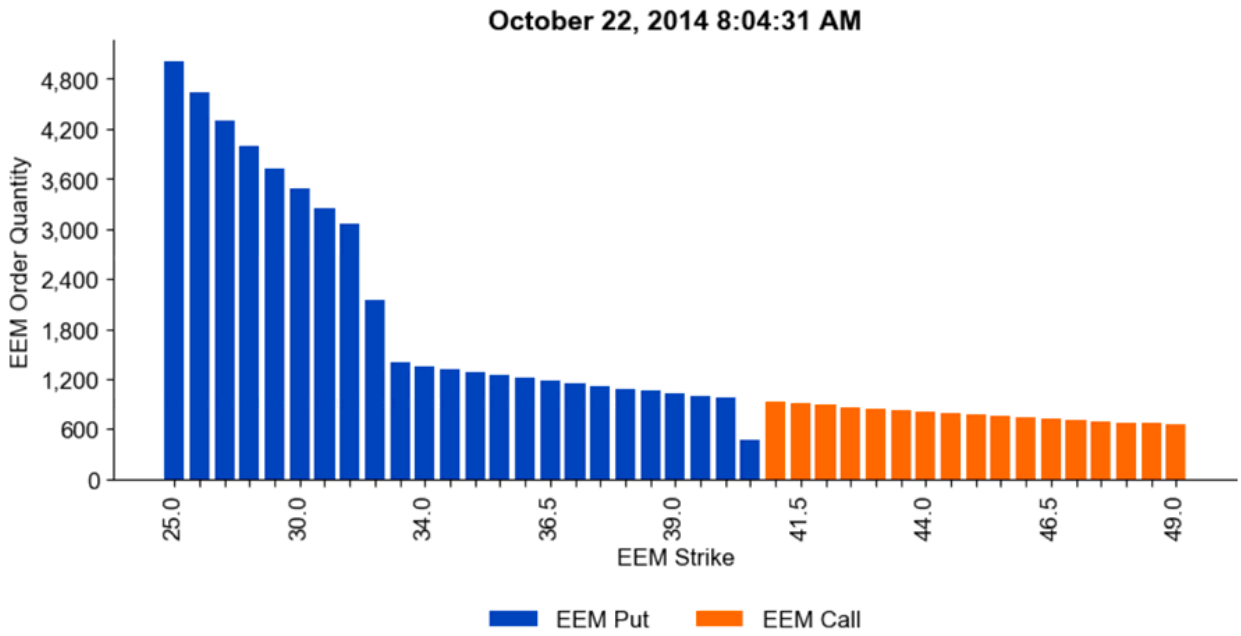
211. And on January 23, 2019, CBOE fined Akuna Securities LLC $1.28 million for "acts detrimental to the Exchange" and "disruptive trading" between November 2016 and November 2017, again referring to "strategy orders" as well as "minimum increment SPX option orders" as part of an attempt to abuse the two-zero bid rule.[64]

212. Plaintiffs took note of what trading patterns CBOE itself apparently found incriminating, and then uncovered nearly identical patterns in numerous other instances in connection with the VIX.

213. *Strategy orders replicating the sensitivity curve*: The imbalance reports for the VXEEM product during the period that led to a fine for DRW for manipulating that product revealed the following pattern:

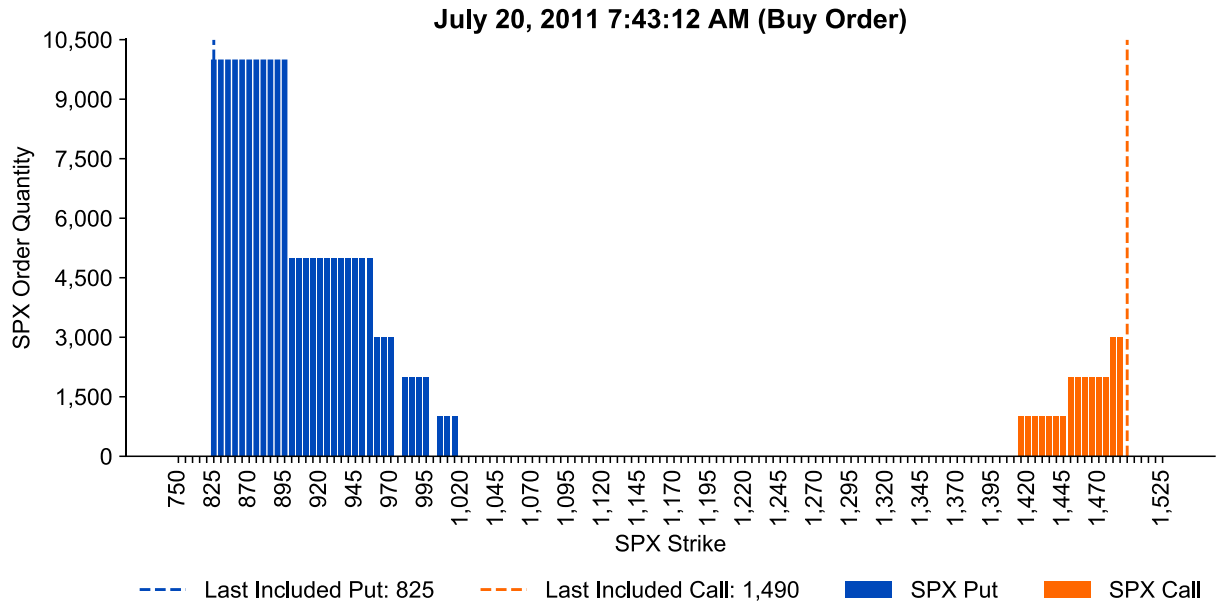
[63] CBOE Business Conduct Committee, *In the Matter of DRW Securities LLC* (Dec. 27, 2017).

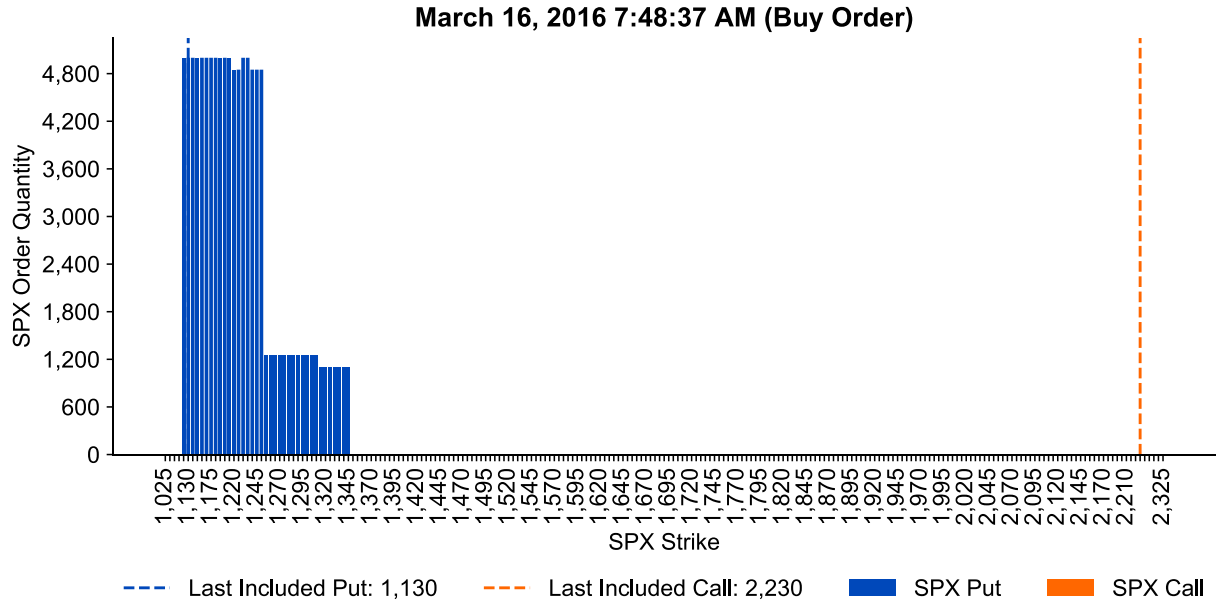
[64] CBOE Business Conduct Committee, *In the Matter of Akuna Securities LLC* (Jan. 31, 2019).



214. Using the VIX imbalance reports and the VIX settlement series published by CBOE, Plaintiffs identified instances where strategy orders were placed in a way that resulted in similar patterns.[65] For example, the following two charts present instances of strategy orders placed in a way that indicate huge trading in the most out-of-the-money SPX put options during the SOQ process—a curved line spiking on the left, not only just like the one above for which DRW was fined, but also just like the sensitivity curve discussed in Section II.B above:

[65] For purposes of this analysis, Plaintiffs have classified an order as a "strategy order" if (1) the strip covers more than 30% of the SPX settlement range, (2) more than 20% of prices within a strip are updated as compared to the previous strip, and (3) for more than 25% of strikes, the order sizes closely follow the VIX formula weighting.

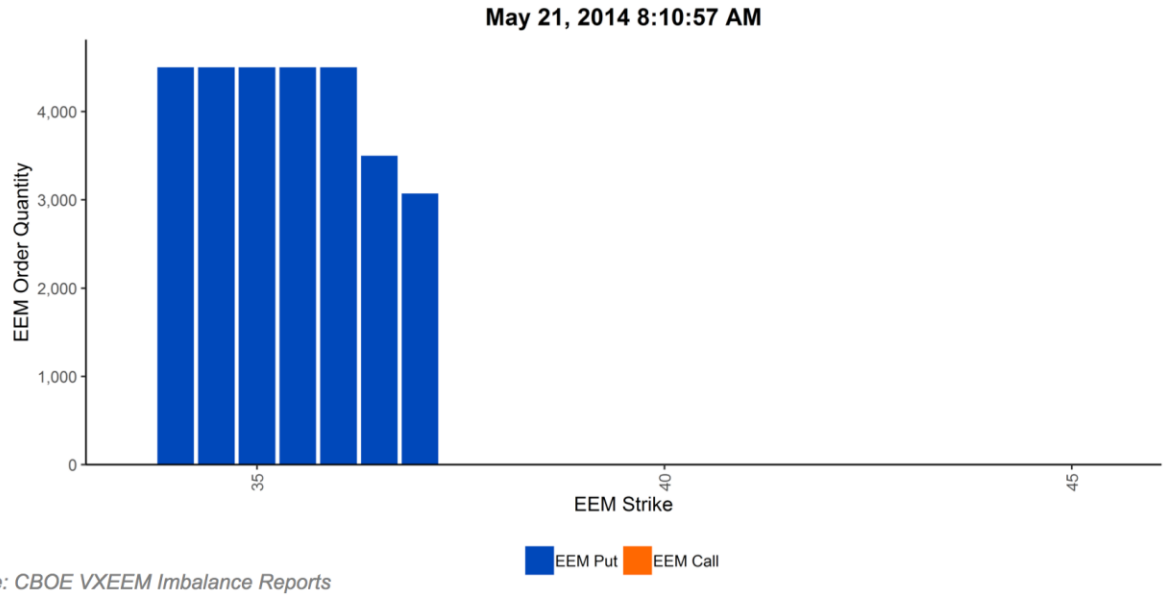




215. These are just two of many examples where the data follows the same pattern CBOE itself has publicly admitted it can use to identify instances of misconduct.

216. *Safety Bids*: As CBOE described in its DRW penalty order, safety bids are a means of "ensuring that certain option series [are] included in the final settlement calculations of the SOQ" because they ensure that there are no "gaps" in the constituent option series as those series become more and more out-of-the-money. Thus, safety bids avoid application of the two

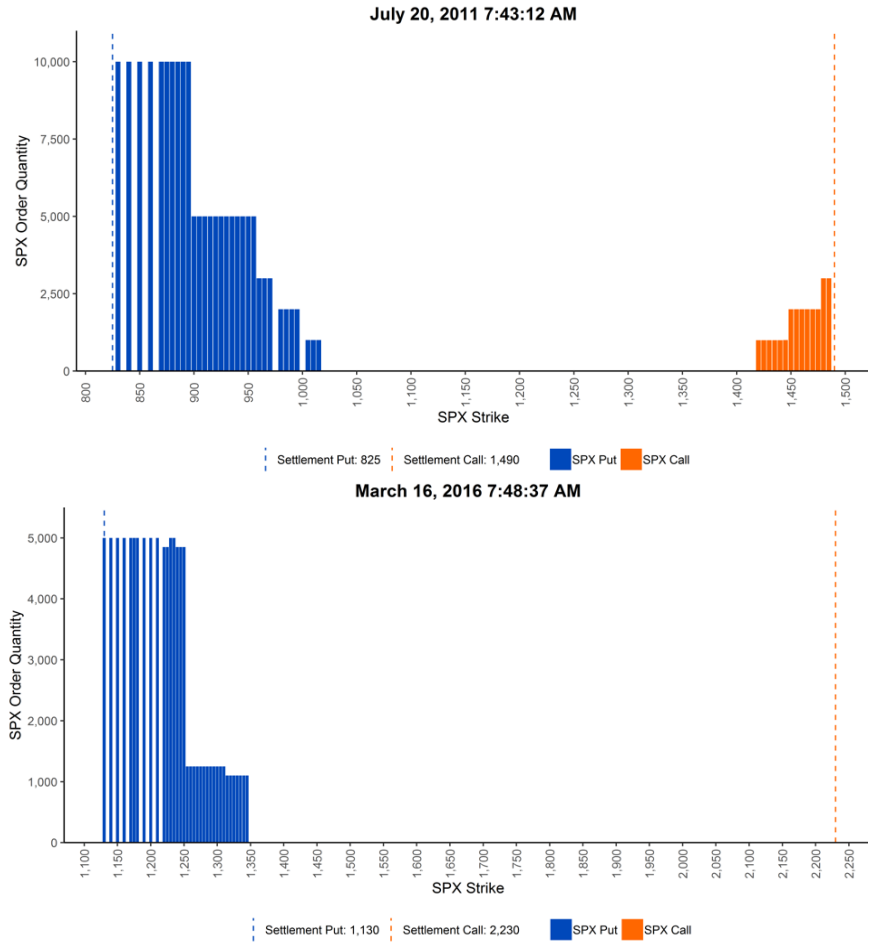
zero-bid rule. For example, the following chart shows a safety bid placed during the time window that CBOE fined DRW for using safety bids to ensure that "the final settlement calculation [for the near identical VXEEM benchmark] included additional options series in the SOQ settlement calculation that otherwise would not have been included":



Source: CBOE VXEEM Imbalance Reports

217. To identify safety bids that resembled the kind for which DRW was fined, Plaintiffs analyzed the VIX Imbalance Reports and Settlement Series data published by CBOE to identify when and how often safety bids were used during the SOQ process. Within these data, Plaintiffs looked for (1) price updates occurring within the same second, which (2) involved at least 5 different strikes with $0.05 bid price, the minimum allowable bid price for SPX options, and which (3) involved at least 5 different strikes with an order quantity of at least 1,000 orders.

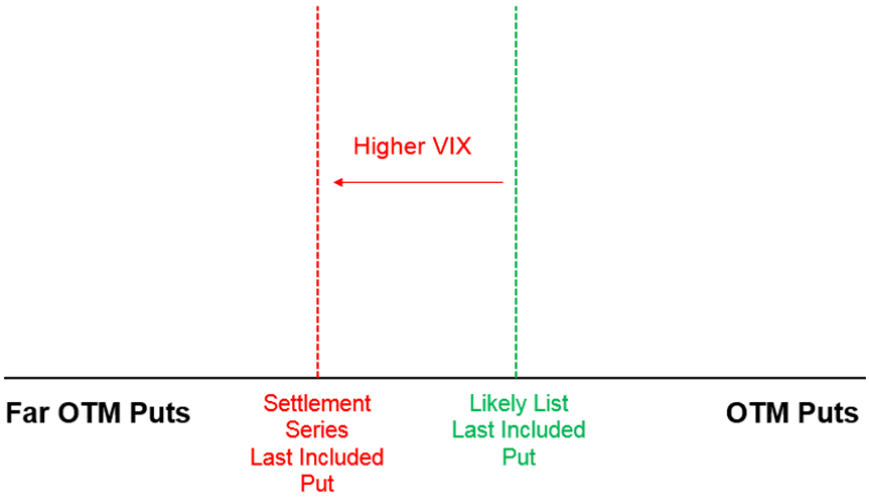
218. The results of these studies again reveal that the practice of placing safety bids to prevent application of the two zero-bid rule—which CBOE itself acknowledges is manipulative when used within an SOQ process—routinely occurred in the VIX SOQ. For example, the following two charts show safety bids being placed for high volumes of deeply out-of-the-money SPX put options during the SOQ process on certain days in 2011 and 2016:



219. All three charts show extremely high volumes of safety bid trades, for very out-of-the-money put positions, with zero volume for trades at- or even close to at-the-money positions. Together, these demonstrate that CBOE's own VIX settlement data show that the VIX SOQ was subject to the use of safety bids in the same way as CBOE has itself recognized as manipulative in respect of another of its near-identically designed volatility benchmarks. Notably, many of the instances where such safety bid abuses were found in the public data coincide with indicia of strategy order abuses discussed above.

220. *Tail Extensions*: Like safety bids, tail extensions worked to ensure that "the final VIX settlement values . . . included certain SPX options series that otherwise would not have

been included due to the Zero Bid rule."[66] However, tail extensions operate not to fill gaps (of two or more SPX Options series) so as to ensure *other* series are included, but instead to add series to the very end so that the new series *themselves* are factored into the calculation.



221. Plaintiffs' analyses demonstrate that the use of tail extensions bears a statistically significant correlation with the degree of deviation in the VIX settlement price. In fact, the average degree of deviation for the monthly VIX settlements where tail extensions were used during the SOQ process is *three times larger* than for those monthly settlements were tail extensions were not used. The difference is statistically significant.

222. Again, as with the strategy order and safety bid analyses described above, this type of trading: (1) was made possible because CBOE deliberately designed the VIX and VIX products in a flawed way that it knew could result in manipulation; (2) is a type of trading that CBOE itself has acknowledged distorts the VIX SOQ process and constitutes manipulation, and (3) is a type of trading that CBOE—better than anyone else —would have known was occurring because it had all the relevant data and front row seats to the misconduct.

[66] *See, e.g.*, CBOE Business Conduct Committee, *In the Matter of Akuna Sec. LLC* (Jan 31, 2019).

C. CBOE Was Aware of the Manipulation Because Its Rules and Regulatory Obligations Gave It an Obligation to Detect and Police Manipulation

223. As a "board of trade," CBOE is required to "establish, monitor and enforce" certain types of rules under Section 7 of the CEA. Among other provisions, the CEA provides that boards of trade shall:

a. "establish, monitor, and enforce compliance with the rules of the contract market, including . . . rules prohibiting abusive trade practices on the contract market," 7 U.S.C. § 7(d)(2)(A);

b. "have the capacity to detect, investigate, and apply appropriate sanctions to any person that violates any rule of the contract market," 7 U.S.C. § 7(d)(2)(A);

c. "list on the contract market only contracts that are not readily susceptible to manipulation," 7 U.S.C. § 7(d)(3); and

d. "have the capacity and responsibility to prevent manipulation, price distortion, and disruptions of the delivery or cash-settlement process through market surveillance, compliance, and enforcement practices and procedures," 7 U.S.C. § 7(d)(4).

224. Examples of CBOE's rules include:

a. Requirements on "Market Makers," "Registered Market Makers," and "Designated Primary Market Makers" to "contribute to the maintenance of a fair and orderly market, and [not to] enter into transactions or make bids or offers that are inconsistent with such a course of dealings." Rule 8.7.

b. Requirements that trading permit holders cannot "effect or induce the purchase, sale or exercise of any security for the purpose of creating or

inducing a false, misleading, or artificial appearance of activity . . . or for the purpose of unduly or improperly influencing the market price of such security . . . or for the purpose of making a price which does not reflect the true state of the market[.]" Rule 4.7.

c. "Neither a Trading Privilege Holder nor any of its Related Parties shall engage or attempt to engage in any fraudulent act or engage or attempt to engage in any scheme to defraud, deceive or trick, in connection with or related to any trade on or other activity related to the Exchange or Clearing Corporation." Rule 601.

d. "Any manipulation of the market in any Contract is prohibited. Orders entered into the CFE System for the purpose of generating unnecessary volatility or creating a condition in which prices do not or will not reflect fair market values are prohibited and any Trading Privilege Holder (including its respective Related Parties) who makes or assists in entering any such Order with knowledge of the purpose thereof or who, with such knowledge, in any way assists in carrying out any plan or scheme for the entering of any such Order, shall be deemed to have engaged in an act detrimental to the Exchange." Rule 603.

225. CBOE's knowledge or reckless disregard for the truth is supported by the existence of many such rules. Such rules serve as further indications of the importance to signaling (falsely) to the market that CBOE's proprietary products were trustworthy products. They also serve as further indicators that CBOE had—or, was reckless not to have—processes in place to tell it that its products were anything but.

D. CBOE's Denials of the VIX Products' Flaws and Manipulation Ring Hollow, Particularly as CBOE Eventually Tried to Fix the Problems It Disclaimed

226. In response to the Griffin and Shams paper, CBOE "vehemently denied the paper's conclusions," saying that the authors "didn't consider the full range of possible reasons other than manipulation that could explain the moves they observed."[67] CBOE's chief regulatory officer, Greg Hoogasian, assured the public that the CBOE "has a dedicated regulatory department that works with FINRA to monitor certain trading activity for our securities markets, including trading activity that could impact the VIX settlement."[68] With regard to the integrity of the VIX itself, CBOE officials said the VIX is a "transparent, closely regulated, and highly reliable gauge of market sentiment with no history of failure."[69]

227. CBOE similarly issued public denials of the whistleblower letter sent to the SEC and CFTC. CBOE Vice President Speth said that the whistleblower's letter contains "a lot of mistakes and a lot of misconceptions" and reinforced the integrity of the entire VIX settlement process: "There are structural safeguards built into the process of the calculation of the VIX settlement value that would hinder the type of manipulation the letter alleges. Our regulatory group actively surveils for potential VIX settlement manipulation."[70]

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[67] Nick Baker & Cecile Vannucci, *What If Somebody Really Is Gaming the VIX?*, Bloomberg (Feb. 13, 2018), https://www.bloomberg.com/news/articles/2018-02-14/billions-in-vix-rigging-profits-a-battered-index-takes-new-hit.

[68] Elliot Blair Smith, *How S&P 500 options may be used to manipulate VIX 'fear gauge'*, MarketWatch (June 19, 2017), https://www.marketwatch.com/story/how-sp-500-options-may-be-used-to-manipulate-vix-fear-gauge-2017-06-19.

[69] *Id.* (emphasis added).

[70] Saqib Iqbal Ahmed & John McCrank, *Whistleblower alleges manipulation of Cboe volatility index*, Reuters (Feb. 13, 2018), https://uk.reuters.com/article/us-usa-stocks-volatility-manipulation/whistleblower-alleges-manipulation-of-cboe-volatility-index-idUKKBN1FX0ES.

228. Nonetheless, faced with mounting allegations of manipulation and increasing public scrutiny of the SOQ process, CBOE CEO Tilly admitted that CBOE was seeking to "enhance" the VIX settlement process and to attract more liquidity to the settlement auction.

229. In June 2018, Bloomberg reported that CBOE had made changes so that it "now offers more and faster data to market participants about the evolution of the monthly auction" and that "its recent migration to a hybridization trading platform is also designed to help elicit more bids and offers from market makers."[71]

230. These changes were reported as being "designed to lure more participation to the monthly auction, which in particular has come under fire for being antiquated and prone to spitting out unusual results," and to "boost[] the number of times the exchange sends signals to traders pertaining to S&P 500 options orders to encourage participation in the auction and responses to buy and sell orders."[72]

231. On September 19, 2018, it was further reported that, "hard pressed to quash allegations its popular 'fear gauge' is being manipulated," with its stock down about 15 percent, "CBOE is working with FINRA, its regulatory services provider, to develop machine learning techniques to tell whether market conditions surrounding the VIX settlement are potentially

[71] Bloomberg, *CBOE Finds More Ways to Fix the VIX, Builds on Prior Tweaks* (June 20, 2018), https://www.bloomberg.com/news/articles/2018-06-20/cboe-reveals-more-ways-to-fix-the-vix-after-first-tweaks-helped.

[72] Financial News, *In a Year of Controversy, Cboe Seeks to Improve the VIX* (June 20, 2018), https://www.fnlondon.com/articles/in-a-year-of-controversy-cboe-seeks-to-improve-the-vix-20180620.

anomalous." "Cboe declined to elaborate on when it began using machine learning techniques to monitor VIX settlements."[73]

232. These belated attempts are further evidence that the SOQ process—based on the manipulated trading of illiquid SPX Options—was fundamentally flawed and in need of reform.

E. CBOE Has *Admitted* to Knowing That the VIX Products and Related Products Were Being Manipulated

233. The problems identified herein were systemic. CBOE did nothing to address or prevent those routine problems from occurring. However, when the problems became so apparent not even CBOE could deny them anymore, it took some token actions in certain limited instances in addition to those described in Section IV.B above. These instances confirm CBOE's ability to identify manipulative acts and its knowledge that manipulation of VIX products was taking place.

a. On August 10, 2015, CBOE fined Ronin Capital $175,000 and ordered disgorgement of $128,000 for violating CBOE rules prohibiting strategy orders after 8:15 a.m.

b. On September 24, 2012, CBOE censured Morgan Stanley and fined it $20,000 for violating CBOE rules prohibiting the entry of VIX future-related strategy orders after 8:15 a.m. and for failing to supervise its employees to ensure compliance with the rules.

c. On April 12, 2012, CBOE fined Sparta Group and a former trader, Andrew Smyth, $50,000 and suspended Mr. Smyth's trading permissions

[73] Reuters, *CBOE Exchange turns to machines to police its 'fear gauge'*, (Sept. 19, 2018), https://www.reuters.com/article/us-cboe-vix/cboe-exchange-turns-to-machines-to-police-its-fear-gauge-idUSKCN1M00HX.

for two weeks for violating various CBOE rules, including conduct concerning VIX Options.

d. On August 17, 2010, CBOE censured Ivan Tchorbadjiyski, fined him $25,000, and suspended his trading permissions for two weeks for violating various CBOE rules, including conduct concerning VIX Options.

e. On August 13, 2010, CBOE censured Steven Berman, fined him $50,000, and suspended his trading permissions for three weeks for violating various CBOE rules, including conduct concerning VIX Options.[74]

V. PLAINTIFFS AND MEMBERS OF THE CLASS WERE HARMED BY DEFENDANTS' MISCONDUCT

A. CBOE Repeatedly and Misleadingly Assured Investors That Its VIX Products Accurately Measured and Reflected Market Volatility, When in Fact They Did Not

234. CBOE has long promoted VIX Options and VIX Futures as an accurate and reliable means for investors to take positions on market volatility. As of the date of filing, for example, CBOE's website promoted both VIX Options and VIX Futures for a variety of purposes, ranging from speculation, to risk management, to portfolio diversification, to hedging:[75]

> Cboe Volatility Index® (VIX®) Options and Futures help you turn volatility to your advantage. Harness it to seek diversification, hedge or capitalize on volatility or efficiently generate income.

[74] *See also In re Wolverine Execution Servs. LLC*, File No. 15-0100 (Dec. 29, 2015) (censuring Wolverine and imposing $50,000 fine for submitting SPX option strategy orders after the cut-off time, and for failing to supervise and prevent the violations), https://www.cboe.com/publish/DisDecision/15-0100.pdf; *In re Wolverine Execution Servs. LLC*, File No. 14-0161 (Feb. 12, 2015) (censuring Wolverine and imposing $15,000 fine for submitting SPX strategy order after the cut-off time), http://www.cboedirect.com/publish/DisDecision/14-0161%20(WEX).pdf.

[75] CBOE, *Turn Volatility To Your Advantage*, http://insight.cboe.com/vix/.

235. Indeed, through its website, CBOE expressly represents VIX Options and VIX Futures as a means for investors to protect themselves against adverse market moves, to cabin or reduce their risk, and to achieve efficient investment returns:

236. CBOE has promoted VIX Options and VIX Futures in this way for years, even as it has changed how it offers them. For example, when CBOE moved from offering VIX Options and VIX Futures with only monthly expiries to offering them with weekly expiries in 2015, it touted this change as allowing "more opportunities" for "more targeted" use of the products to reduce risk or for investment:

237. Through the fact sheets that it published for its VIX products, CBOE stressed that the VIX index was "a leading measure of market expectations of near-term volatility."[76] CBOE also stressed that "[t]he addition of weekly expirations to standard monthly features and options expirations offers volatility exposures that more precisely track the performance of the VIX

[76] Cboe, *VIX Futures and Options* (2018, v 1.2), http://www.cboe.com/micro/vix/pdf/vix-fut-and-options-cboe-vix-fact-sheet.pdf.

Index."[77] Similarly, CBOE emphasized that "[w]ith the launch of VIX Futures at Cboe Futures Exchange (CFE) in 2004 and VIX Options at Cboe in 2006, there has been a growing acceptance of trading VIX and VIX-linked products as risk management tools."[78]

238. All of these representations to the market regarding the accuracy and reliability of VIX Options and VIX Futures as trading and investment products were part of CBOE's concerted efforts to grow its VIX franchise to increased profitability.

239. In 2007, CBOE engaged in a "new branding campaign" through which it wanted to "communicat[e] to the world that CBOE is a vital necessity in the options marketplace for which there is no substitute."[79] By 2012, CBOE was marketing its creation of weekly expiring VIX Options as allowing investors "targeted trading strategies around market news and events."[80]

240. In essence, CBOE stoked demand for its products throughout its advertising, marketing campaigns, web and print product descriptions, annual reports, and elsewhere, while disguising the reality that its desire for fees and commercial self-interest had undermined the integrity of the VIX derivative market.

241. With CBOE's assurances to the market that CBOE's VIX Options and VIX Futures products were fair and orderly, investors have poured billions of dollars into them. They did so believing that the prices at which they bought, sold, and settled those products were

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[77] *Id.* at 2.

[78] *Id.* at 2.

[79] CBOE, Annual Report 2006, at 3, http://www.cboe.com/framed/pdfframed?content=/aboutcboe/annualreportarchive/annualreport2006.pdf&section=SEC_ABOUT_CBOE&title=Cboe+Annual+Report+2006.

[80] CBOE, Annual Report 2012, at 4, http://www.cboe.com/framed/pdfframed?content=/aboutcboe/annualreportarchive/annualreport2012.pdf&section=SEC_ABOUT_CBOE&title=Cboe+Annual+Report+2012.

determined by natural market forces of supply and demand—not rigged by manipulators who CBOE enabled to game the obscure VIX settlement process. Similarly, investors traded SPX Options, and VIX ETPs, believing that prices for these products were also determined by natural market forces.

242. Plaintiffs and Class members were thus harmed because they were transacting in products that were not the result of regular forces of supply and demand. Rather, Plaintiffs and members of the class were tricked into trading SPX Options, VIX Options, VIX Futures, and VIX ETPs that were mispriced due to CBOE or settled at manipulated prices due to CBOE and the John Doe Defendants' manipulative conduct. As a result, class members were forced to pay more for (or accept less from) these products than they would have in a fair and orderly market.

243. Plaintiffs and Class members relied upon the fairness of the VIX SOQ process, including, for example, when they accepted CBOE's calculations for the cash settlement of their VIX Options and VIX Futures. They would not have done so if they had known CBOE's calculations were the product of a manipulated process.

244. Plaintiffs and Class members are entitled to a presumption of reliance under *Affiliated Ute Citizens of Utah v. U.S.*, 406 U.S. 128 (1972), because the claims asserted herein against Defendants are predicated in part upon material omissions of fact (e.g., the manipulation of the SOQ settlement process) that Defendants had a duty to disclose.

245. In the alternative, Plaintiffs and Class members are entitled to a presumption of reliance pursuant to the fraud-on-the-market doctrine. Throughout the Class Period, Plaintiffs and the Class relied upon an assumption of an efficient market free of manipulation. Investors believed they were trading in competitive markets where prices were driven by supply and demand and were not tainted by manipulation.

B. Plaintiffs Were Harmed by Identified Instances of Manipulation When They Held VIX Products to Settlement on Manipulation Days

246. A simple way to show named Plaintiffs were actually impacted would be to determine whether an act of SOQ manipulation on a specific day caused harm to instruments held to settlement that same day. Plaintiffs did this, by using the "deviation" concept discussed above.[81] This analysis determined whether the VIX settlement process resulted in a value that was statistically significantly higher or lower than the value of the VIX when the market opened immediately upon conclusion of the VIX settlement process. This showed whether and in what direction a given SOQ process was manipulated.

247. Class members who held VIX Options and VIX Futures through to settlement were harmed under this measure of deviation because VIX Options and VIX Futures cash-settle based on the SOQ settlement process. The manipulation of the SOQ process thus directly impacted whether and how much class members would be paid. The manipulation also pushed some VIX Options and VIX Futures into the money when they would have otherwise expired out of the money, and pushed some VIX Options and VIX Futures out of the money when they would have otherwise expired in the money.

248. For those named Plaintiffs who held a relevant VIX Product through to cash settlement on a day when the SOQ process was manipulated, it was thus possible to use this

[81] More specifically, this measure of deviation takes the difference between the VIX settlement price and the market open intraday VIX price on a given settlement day, only if the amount of that difference cannot be explained by prices throughout the remainder of that day. This analysis only flagged a given SOQ process as artificial if it was found with a 99.9% confidence level that the degree of price deviation shown *cannot* be explained by the volatility during the remainder of that day. Plaintiffs also tested for harm on settlement using the measure of deviation discussed in the lasting impact Section below. This additional analysis found that the Plaintiffs named in this Section V.B below were similarly harmed on their VIX products held to settlement.

measure of deviation to determine whether those Plaintiffs were on the losing side of the artificiality caused by the manipulation.

249. Plaintiff Richard S. Aaron held multiple long VIX put option positions to expiration on dates during the Class Period where the above methodology confirms he was forced to pay more (or accept less) in settlement due to manipulation occurring that day. Examples include, but are not limited to, the settlements on January 18, 2017, and October 18, 2017.

250. Plaintiff Spencer Bueno held VIX Options positions to expiration on dates during the Class Period where the second methodology discussed in footnote 81 confirms he was forced to pay more (or accept less) in settlement due to manipulation occurring that day. Examples include, but are not limited to, the settlement on August 19, 2015.

251. Plaintiff Victor Choa held multiple long and short VIX Futures positions to expiration on dates during the Class Period where the above methodology confirms he was forced to pay more (or accept less) in settlement due to manipulation occurring that day. Examples include, but are not limited to, the settlements on April 19, 2017; July 19, 2017; August 16, 2017; and January 17, 2018.

252. Plaintiff FTC Capital held multiple long VIX Futures positions to expiration on dates during the Class Period where the above methodology confirms it was forced to pay more (or accept less) in settlement due to manipulation occurring that day. Examples include, but are not limited to, the settlement on August 22, 2012.

253. Plaintiff Amy Huang held multiple put and call VIX Option positions to expiration on dates during the Class Period where the above methodology confirms she was forced to pay more (or accept less) in settlement due to manipulation occurring that day.

Examples include, but are not limited to, the settlements on March 21, 2012; August 22, 2012; February 13, 2013; March 20, 2013; May 22, 2013; June 22, 2013; July 17, 2013; August 21, 2013; November 20, 2013; April 16, 2014; and August 20, 2014.

254. Plaintiff LRI Invest held multiple short VIX Future positions to expiration on dates during the Class Period where the above methodology confirms it was forced to pay more (or accept less) in settlement due to manipulation occurring that day. Examples include, but are not limited to, the settlement on July 19, 2017.

255. If one presumes that the impact of SOQ manipulation is confined to a tight window of time around the SOQ process—which, Plaintiffs do not believe is the case—then the above Plaintiffs were indisputably harmed. This is because, if there is no lasting impact from SOQ manipulation, then there was no price artificiality when Plaintiffs purchased their instruments; the only impact was at the time of settlement. These Plaintiffs thus were harmed even if one applies a "netting" analysis to these transactions (which Plaintiffs do not believe is required) as there would have been no gains at the time they purchased their VIX Options or VIX Futures against which to "net" their losses at the time they settled those products.

C. Plaintiffs Were Harmed by the Lasting Impact of Identified Instances of Manipulation

1. Defendants' fraudulent conduct had a lasting impact on prices

256. The process discussed in Section V.B does not in fact capture all of the harm caused by the fraudulent and manipulative acts at issue. This is because—as recognized by the academic literature and Plaintiffs' statistical analyses—it is inappropriate to presume that there is no lasting impact from an attempt to "bang the close" in the SOQ process.

257. Instead, an extensive body of accepted academic literature recognizes that trades (and offers to trade) in financial instruments have a lasting (sometimes, permanent) impact on

prices of those instruments. In an efficient market, the prices attached to such trades and offers to trade are presumed to reflect all material information. This is often referred to as the "market efficiency hypothesis." Malkiel and Fama (1970) concluded in their review of the hypothesis that "in short, the evidence in support of the efficient markets model is extensive and (somewhat uniquely in economics) contradictory evidence is sparse."[82]

258. Academic literature, in a field concerned with what are known as "market microstructure models," builds on the theory of informed trading to show that trades of financial instruments have a lasting impact on prices. For example, O'Hara has summarized the key insights of the market microstructure model as follows: "In their canonical form, such models rely on a basic story: some traders have private information and they trade on it; other traders see market data and they learn from it; and market prices adjust to efficient levels that reflect the information."[83]

259. Pursuant to these well-recognized economic theories, buy orders tend to drive prices up, and sell orders tend to drive prices down, even beyond their temporary impact on availability. This understanding—that trades have permanent price impact—has been the subject of widespread theoretical agreement and empirical confirmation since the beginning of the market microstructure literature.[84] The fact that trades will impact prices also makes possible

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[82] Burton G. Malkiel & Eugene F. Fama, *Efficient Capital Markets: A Review Of Theory and Empirical Work*, The Journal of Finance, 25(2), 383-417 (1970).

[83] Maureen O'Hara, *High Frequent Market Microstructure*, Journal of Financial Economics, 116 (2), 257-270 (2015).

[84] For example, Lawrence Glosten and Paul Milgrom, *Bid, Ask and Transaction Prices In a Specialist Market With Heterogeneously Informed Traders*, 14 J. of Financial Econ. 71 (1985), concluded that trades can have permanent price impact. In technical terms, Glosten-Milgrom's model shows that prices changes are not autocorrelated, and that prices are a "martingale." This means that a trade moves prices, and conditional on all trades up to a given time, the best forecast of future prices is the current price. This is another way of saying that the

manipulative trading strategies, i.e., trading strategies that are intended to, and have the effect of, causing prices to diverge from their competitive values that accurately reflect information available at a particular point in time, as alleged in this case. For instance, Professor Craig Pirrong, in *The Economics of Commodity Market Manipulation*, 5 J. of Commodity Markets (2017) 1, reviews the literature on trade-based manipulation and presents empirical evidence related to alleged "bang the settlement" manipulation by a trading firm.[85]

260. Plaintiffs' economists have drawn upon the efficient market and market microstructure literature to construct a model that measures the temporary and lasting impact of manipulative trades on the SOQ price and the VIX, using four steps.

261. *Step one* is the identification of SOQ processes that were manipulated. Any one or a combination of the "screens" discussed above in Section II could have been used to do so, since they each demonstrate that manipulation was taking place. However, in order to more consistently compare results across the different types of tests discussed above, Plaintiffs focused on certain screens that covered both monthly and weekly settlements. To be conservative, for purposes of this Section, Plaintiffs required a SOQ process show signs of manipulation across *all*

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information remains in the price. Similar results are shown in the other seminal theoretical microstructure paper, Albert S. Kyle, *Continuous Auctions and Insider Trading*, 53 Econometrica 1315 (1985), and the extension of the Kyle model to continuous time, Kerry Back, *Insider Trading in Continuous Time*, 5 Rev. of Fin. Stud. 387 (1992). The empirical literature focuses on quantifying the relative contribution of these components, but has reached a consensus as to the existence of the lasting impact.

[85] By way of other examples, Praveen Kumar and Duane Seppi, *Futures Manipulation With Cash Settlement*, 47 J. of Fin. (1992) 1485, modeled how a manipulator can profit from manipulation given the existence of both temporary and lasting impacts from manipulative trading activity. And Carole Comerton-Forde and Talis J. Putnins, *Measuring Closing Price Manipulation*, 20 J. of Financial Intermediation (2011) 135, presents empirical evidence on the price effects of 184 manipulations of the closing prices on US and Canadian stock exchanges.

three screens, as well as in the "deviation" test below, before it was treated as a manipulation event.[86]

262. *Step two* is to determine the initial size of the impact—or the "temporary impact"—from the fraudulent manipulation. This is where the impact of the manipulation is at its maximum. The temporary impact is measured as the difference between the intraday VIX immediately before and after the VIX SOQ settlement window. However, Plaintiffs also employed a "control" which ensures that what is being captured is only the temporary impact caused by the manipulation of the SOQ process, and not movement in response to some contemporaneous market event.[87]

263. *Step three* is to calculate the degree of price impact (after being subject to the control) that has lasting effect. As discussed above, the academic literature holds that there is a longer-lasting—and not merely temporary—impact from manipulative events. Plaintiffs' experts thus employed an autoregression model to determine how long the manipulation had an impact on the VIX. The initial size of the measured impact was decayed over time, though consistent with the academic literature it only approached but never fully reached zero.

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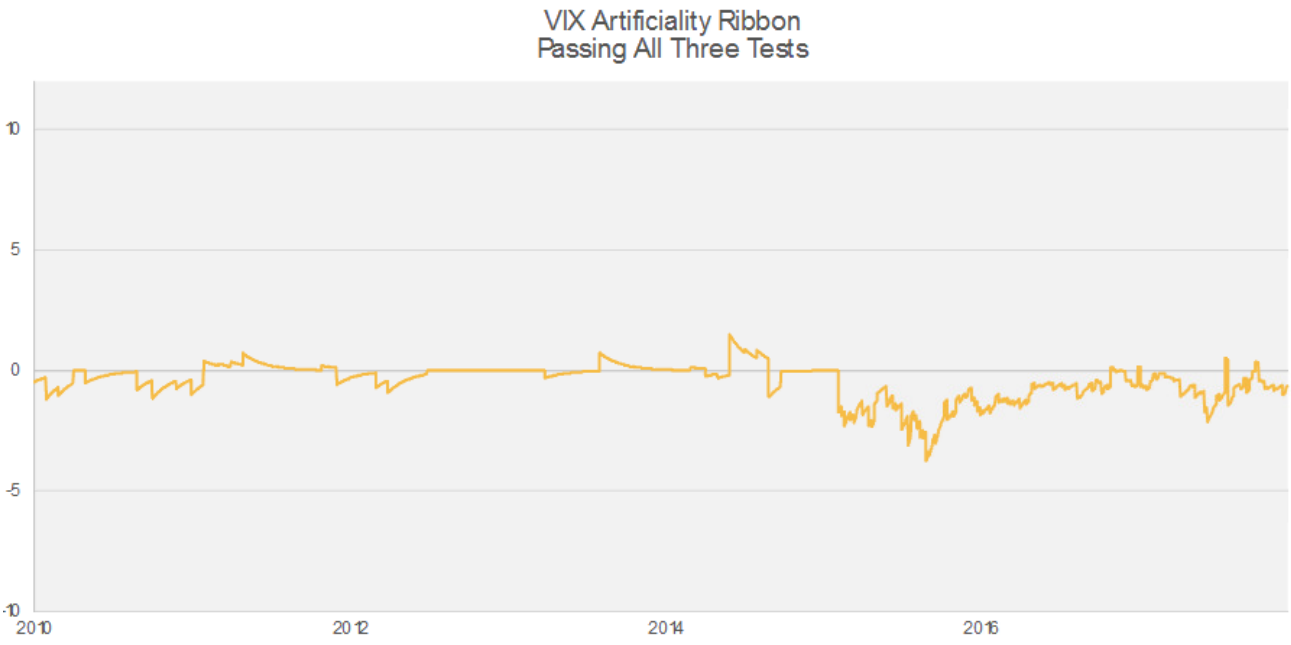
[86] Specifically, the three "screens" Plaintiffs used for purposes of this analysis involved determinations of whether: (1) the ratio between trading volumes of put and call SPX options during a given SOQ process and determines exceeds the same ratio during the remainder of the same trading day; (2) there was a negative correlation between the trading volume of SPX put options and the moneyness of SPX put options; and (3) there is increased trading volume on out-of-the-money SPX Options that have large gaps between the series of strike prices. All of these analyses are described in more detail above. *See, e.g.*, Section II at ¶¶ 97, 106 & 112.

[87] Plaintiffs used the CBOE S&P100 Volatility Index (the "VXO") as a control to adjust the temporary impact amount because: (1) there is no SOQ mechanism in VXO's calculation, and therefore it is not likely to be affected by similar manipulation; (2) VXO is calculated based on the Black-Scholes implied volatility of S&P 100 options and not the prices of S&P 500 options, and therefore is unlikely to be affected by manipulation of the prices of SPX options; and (3) VIX and VXO are typically highly correlated on an intraday level.

264. *The fourth step* is to chart out over time the level of artificiality for multiple manipulation events to build an artificiality "ribbon." Each new manipulation moves the line more positive or more negative, depending on the direction of artificiality. The degree of artificiality then tends towards zero as the impact of all past manipulation events decay—unless and until, of course, a new manipulation event occurs. The important thing here is that at any given time, the level of artificiality is *not* merely that caused by the very last manipulation event. Rather, it is the result of the cumulative impact of all prior manipulation events, after taking into account the degradation of that impact over time.

265. For example, if one were to be overly conservative and demand that only those settlements that had indicia of being manipulated according to *all three* of the "screens" *and* show "diversion" would count as a "manipulation event," the level of artificiality at any point would look like this:[88]

[88] This example ribbon commences at 2010 because that is the first date at which the data for all four of the tests discussed in this section are all available. The ribbon as filtered through fewer (or different) screens, or with data in CBOE's control, can be run for a longer time period.



VIX Artificiality Ribbon, Source: Reuters, CBOE

2. Lasting impact of the fraudulent manipulation was felt in all relevant instruments

266. The above analyses speak in terms of the artificiality of the VIX itself and the VIX SOQ settlement price. To be clear, however, the measured, lasting level of artificiality applied to all VIX-related products, not just those held to settlement.

267. The fair value of a futures contract can be calculated as the sum of spot prices. This implies that futures and spot prices should be highly correlated in efficient markets. It also implies that a shock to the spot price of an underlying asset will affect futures prices in the same direction.[89] Indeed, several authors have modeled the relationship between VIX Futures and VIX spot prices and found results consistent with this theory.[90] Plaintiffs' experts adapted Frijns

[89] Chartered Institute for Securities and Investments, *Derivatives* 77 (2013).

[90] Shu and Zhang (2012) find a statistically causal relationship from changes in the VIX spot prices to changes in VIX futures prices using end of the day data, *see* Jinghong Shu & Jin E. Zhang, Working Paper, University of Auckland, *Causality In The VIX Futures Market* Journal of Futures Markets 32(1), 24-46 (2012), while Frijns et al. find that this relationship also holds on

et al.'s approach and built a time series model using hourly intraday VIX data from 2012 to 2018. Plaintiffs' experts then tested whether changes in the VIX spot price "Granger-cause" changes in the VIX Futures price.[91] The results demonstrate movements in the VIX are correlated with movements in VIX Futures, as one would expect.

268. VIX Options are priced based on a curve of expected, future values for the VIX index. This can be inferred from VIX Futures prices because the price of a VIX Future expiring in *N* months' time serves as a proxy for the market's expectation for the VIX index in *N* months' time, which thus serves as a suitable substitute for pricing a VIX Option expiring in *N* months' time. Given that an analysis of Granger causality shows that VIX Futures move with changes in the VIX itself, it is therefore not surprising that the prices of VIX Options also move similarly across tenors in response to movements in the VIX itself. Given it generally holds true that the price of an option will increase/decrease when the implied volatility of the underlying asset increases/decreases, and given the VIX is a measurement of the implied volatility of SPX Options, anyone who traded in SPX Options will also have been harmed by movement of the VIX.

269. Lastly, class members who transacted in VIX ETPs were also harmed by movement in the price of the VIX because such products derive their value from movements in VIX, VIX Futures, VIX Options, and/or SPX Options. For example, the iPath S&P 500 VIX Short-Term Futures ETN (symbol "VXX") is "designed to provide investors with exposure to

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an intraday level. *See* Frijns, et al., *On The Intraday Relation Between VIX And Its Futures* (2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2387877.

[91] Granger Causality is a well-established statistical measure of how well changes in one time series "explain" another. Plaintiffs' experts ran their tests separately first for each year in the data, and then—to be extra conservative—for each day in the data. This required running approximately 1,500 regressions for the daily models.

one or more maturities of futures contracts on the CBOE Volatility Index."[92] As such, the overall value of the VXX, and the value of any notes held in the VXX, was directly impacted by movements in the price of VIX Futures contracts. Other VIX ETPs were similarly directly impacted depending on their composition (i.e., the VIX products on which they were based) and their orientation (i.e., whether they were designed to be positively or inversely orientated to the value of the products on which they were based).

270. In sum, the correlation between manipulative inflation or suppression of the VIX, and the harm to named Plaintiffs and the class given their various postures in respect of the VIX products and related instrument, is as follows:[93]

	HARMED ON SETTLEMENT	HARMED ON TRANSACTION
VIX Futures	Long positions of VIX futures on settlement days when the VIX was suppressed. Short positions of VIX futures on settlement days when the VIX was inflated.	Purchases of VIX futures on days when the VIX was inflated. Sales of VIX futures on days when the VIX was suppressed.
VIX Options	Long positions of call VIX options on settlement days when the VIX was suppressed. Short positions of call VIX options on settlement days when the VIX was inflated. Long positions of put VIX options on settlement days when the VIX was	Purchases of call VIX options on days when the VIX was inflated. Sales of call VIX options on days when the VIX was suppressed. Purchases of put VIX options on days when the VIX was suppressed. Sales of put VIX options on days when

[92] iPath® Series B S&P 500® VIX Short-Term Futures ETN Pricing Supplement to Prospectus dated March 30, 2018, at 1 (May 2, 2019), http://www.ipathetn.com/US/16/en/documentation.app?instrumentId=341408&documentId=6683317.

[93] Note that, if a held-to-settlement options position was out-of-the-money in both the actual and but-for world there will be no held-to-settlement damages. Rather, this table applies only to held-to-settlement damages in respect of an options position where: (1) the manipulation has changed the moneyness of the position, and (2) the position was in-the-money in the but-for world.

	inflated. Short positions of put VIX options on settlement days when the VIX was suppressed.	the VIX was inflated.
SPX Options	Inapplicable.	Purchases of SPX options on days when the VIX was inflated. Sales of SPX options on days when the VIX was suppressed.
ETPs	Inapplicable.	Purchasers of shares or notes in positively orientated ETPs on days when VIX was inflated. Sellers of shares or notes in positively orientated ETPs on days when VIX was suppressed. Purchasers of shares or notes in negatively orientated ETPs on days when VIX was suppressed. Sellers of shares or notes in negatively orientated ETPs on days when VIX was inflated.

271. Accordingly, Plaintiffs and class members were harmed by manipulation of the VIX SOQ process because they were forced to pay more for (or to accept less from) these products on settlement, or to pay more for (or to accept less from) these products when they bought or sold them, than they would have in a fair and orderly market. As discussed in Section V.D.4 below, Plaintiffs here were harmed in this way even assuming that they have to take into account the impact of the manipulation on both legs of a given transaction.

3. Application of Plaintiffs' impact analyses to Plaintiffs' trading data confirms they were harmed by the lasting impact of the manipulation

272. As discussed in Section V.B above, certain Plaintiffs were harmed when they held certain instruments through settlement, based on identified manipulative activity during that day's SOQ process. Plaintiffs also analyzed their VIX products held through settlement, and confirmed they were harmed even if one applies the cumulative level of artificiality calculated from the process above, rather than just from the manipulation of a single SOQ process.[94]

273. In addition, for the reasons set forth above, Plaintiffs and Class members who did *not* hold their instruments through to expiration were harmed because prices for VIX products and SPX Options were artificial even outside of the settlement window.

274. Applying the lasting-impact "ribbon" to the Plaintiffs' transactions allows these harms to be captured as well. For instance, those who bought VIX products and SPX Options when prices were still "too high," or who sold VIX products and SPX Options when prices were still "too low," paid an artificial price and were thereby harmed.

275. In particular, using the above methodologies, and on the basis of the damages chart set out at paragraph 270 above, Plaintiffs have confirmed this additional harm as follows:

276. Plaintiff Richard S. Aaron traded multiple VIX Options on dates during the Class Period at times when prices were artificial in a way that caused him harm—that is, he bought for more or sold for less (or both) than he otherwise would have. Examples include, but are not limited to, trades on January 31, 2014, September 22, 2016; September 27, 2016; October 3, 2016; October 26, 2016; October 28, 2016; November 10, 2016; November 25, 2016; December

[94] Examples include the VIX Futures settled by Victor Choa on July 19, 2017, and the VIX Options settled by Mr. Choa on December 30, 2015; the VIX Futures settled by FTC Capital on August 22, 2012; the VIX Options settled by Amy Huang on August 22, 2012 and February 13, 2013; and the VIX Futures settled by LRI Invest on July 19, 2017.

1, 2016; December 7, 2016; December 19, 2016; December 21, 2016, December 20, 2017, and hundreds of other trades on other dates.

277. Plaintiff Spencer Bueno traded multiple SPX Options on dates during the Class Period at times when prices were artificial in a way that caused him harm—that is, he bought for more or sold for less (or both) than he otherwise would have. Examples include, but are not limited to, trades on March 15, 2017; March 27, 2017; and April 13, 2017. Mr. Bueno also traded multiple VIX Options on dates during the Class Period at times when prices were artificial in a way that caused him harm—that is, he bought for more or sold for less (or both) than he otherwise would have. Examples include, but are not limited to, trades on June 28, 2016, March 27, 2017, and February 11, 2016.

278. Plaintiff Dale Cary traded multiple VIX Options on dates during the Class Period at times when prices were artificial in a way that caused him harm—that is, he bought for more or sold for less (or both) than he otherwise would have. Examples include, but are not limited to, trades on July 17, 2013.

279. Plaintiff Victor Choa traded multiple VIX Futures on dates during the Class Period at times when prices were artificial in a way that caused him harm—that is, he bought for more or sold for less (or both) than he otherwise would have. Examples include, but are not limited to, trades on September 3, 2015; September 15, 2015; September 23, 2015; November 9, 2016; November 28, 2016; December 1, 2016; December 28, 2016; December 29, 2016; April 17, 2017; April 18, 2017; July 10, 2017; August 10, 2017; August 14, 2017; August 15, 2017; August 17, 2017; September 26, 2017; and November 27, 2017. Mr. Choa also traded multiple SPX Options on dates during the Class Period at times when prices were artificial in a way that caused him harm—that is, he bought for more or sold for less (or both) than he otherwise would

have. Examples include, but are not limited to, trades on April 27, 2015; June 2, 2015; August 6, 2015; October 1, 2015; November 6, 2015; January 4, 2016; March 4, 2016; May 6, 2016; July 13, 2016; September 7, 2016; and hundreds of other trades on numerous other dates. Mr. Choa also traded multiple VIX Options on dates during the Class Period at times when prices were artificial in a way that caused him harm—that is, he bought for more or sold for less (or both) than he otherwise would have. Examples include, but are not limited to, trades on October 20, 2015 and November 13, 2015.

280. Plaintiff FTC Capital traded multiple VIX Futures on dates during the Class Period at times where prices were artificial in a way that caused it harm—that is, it bought for more or sold for less (or both) than it otherwise would have. Examples include, but are not limited to, trades on March 23, 2012; April 19, 2012; April 20, 2012; April 23, 2012; April 27, 2012; May 1, 2012; May 3, 2012; May 4, 2012; May 7, 2012; May 8, 2012; May 9, 2012; May 10, 2012; May 14, 2012; May 18, 2012; June 5, 2012; June 13, 2012; June 15, 2012; and thousands of other trades on numerous other dates.

281. Plaintiff Amy Huang traded multiple put and call VIX Options on dates during the Class Period at times when prices were artificial in a way that caused her harm—that is, she bought for more or sold for less (or both) than she otherwise would have. Examples include, but are not limited to, trades on September 11, 2013; October 4, 2013; November 19, 2013; December 17, 2013; January 21, 2014; February 11, 2014; February 13, 2014; March 4, 2014; May 29, 2014; August 19, 2014; September 19, 2014; October 3, 2014; October 16, 2014; October 28, 2014; October 29, 2014; November 7, 2014; and hundreds of other trades on numerous other dates.

282. Plaintiff LRI Invest traded multiple VIX Futures on dates during the Class Period at times when prices were artificial in a way that caused it harm—that is, it bought for more or sold for less (or both) than it otherwise would have. Examples include, but are not limited to, trades on March 23, 2012; May 15, 2012; December 17, 2012; February 6, 2013; July 30, 2013; September 30, 2013; July 10, 2014; August 22, 2014; March 6, 2015; August 24, 2015; and hundreds of other trades on numerous other dates. LRI Invest also traded multiple VIX Options on dates during the Class Period at times when prices were artificial in a way that caused it harm—that is, it bought for more or sold for less than it otherwise would have. Examples include, but are not limited to, trades on August 29, 2012; January 11, 2013; March 8, 2013; April 8, 2013; February 20, 2014; December 17, 2014; January 27, 2015; April 8, 2015; May 6, 2015; July 18, 2016; and thousands of other trades on numerous other dates.

283. Plaintiff John Pels traded multiple VIX Futures on dates during the Class Period at times when prices were artificial in a way that caused him harm—that is, he bought for more or sold for less (or both) than he otherwise would have. Examples include, but are not limited to, trades on January 8, 2016; April 11, 2017; and December 6, 2017. Mr. Pels also traded multiple VIX Options on dates during the Class Period at times when prices were artificial in a way that caused him harm, that is, he bought for more and/or sold for less than he otherwise would have. Examples include, but are not limited to, trades on February 19, 2016; November 3, 2016; May 26, 2017; and June 29, 2017.

4. Plaintiffs were harmed from the lasting impact even on a "net" basis

284. Because of the measured decaying impact, it is highly unlikely that the harm observed in the named Plaintiffs' transactions was matched up evenly against an earlier benefit as to "net out," as is sometimes argued to be the case in the simpler context of a stock purchaser who bought after a misrepresentation but sold before the truth was revealed. Further, it is a

relatively simple exercise for stockholders to compare the dates of purchase, sale, misrepresentation, and disclosure. By contrast, establishing "net" harm here is much more complex, and much more reliant on information known only to CBOE and the Doe Defendants.

285. Despite this, Plaintiffs have also attempted to confirm that named Plaintiffs entered into transactions where the fraudulent and manipulative acts caused more harm than they (for purposes of argument only) caused a benefit. Applying the artificiality ribbon to even a sample of Plaintiffs' transactions confirms those Plaintiffs were harmed even presuming the "losses" associated with the level of artificiality at one point in time on a transaction should be "netted" as against the "gains" associated with the level of artificiality at another point in time. A few examples are below.

286. On September 27, 2016, Richard S. Aaron entered into 135 purchase contracts for put VIX Options expiring in October 2016, with a strike price of 14. On October 26, 2016, Mr. Aaron entered into 120 sales contracts for call VIX Options expiring in November 2016, with a strike price of 18. By way of a final example, on December 19, 2016, Mr. Aaron entered into 50 purchases contracts for put VIX Options expiring in December 2016, with a strike price of 13. Comparing these transactions to the artificiality "ribbon" indicates that Mr. Aaron was harmed, even if one were to apply a "net" analysis to these transactions.

287. Between March 27, 2017, and March 31, 2017, Spencer Bueno entered into purchase and 10 sales contracts for put SPX Options expiring in June 2017, with a strike price of 2000. Comparing both sides of these transactions to the artificiality "ribbon" indicates that Mr. Bueno was harmed even if one were to apply a "net" analysis to these transactions.

288. Between July 17, 2013, and August 6, 2013, Dale Cary entered into 500 purchase and 500 sales contracts for call VIX Options expiring in September 2013. Comparing both sides

of these transactions to the artificiality "ribbon" indicates that Mr. Cary was harmed even if one were to apply a "net" analysis to these transactions.

289. On July 10, 2017, Victor Choa entered into 2 sales contracts for VIX Futures expiring in July 2017. On July 7, 2015, Mr. Choa entered into a sales contract for an SPX Option expiring in July 2015. And on June 18, 2015, Mr. Choa entered into 2 purchase contracts for SPX Options expiring in June 2015. Comparing both sides of these transactions to the artificiality "ribbon" indicates that Mr. Choa was harmed even if one were to apply a "net" analysis to these transactions.

290. Between February 14, 2014, and March 14, 2014, FTC Capital entered into 503 purchase and 503 sales contracts for VIX Futures expiring in March 2014. Comparing both sides of these transactions to the artificiality "ribbon" indicates that FTC Capital was harmed even if one were to apply a "net" analysis to these transactions.

291. Between December 12, 2014, and January 2, 2015, Amy Huang entered into 205 purchase and 205 sales contracts for call VIX Options expiring in January 2015, with a strike price of 22. Between June 13, 2017, and July 14, 2017, Ms. Huang entered into 225 purchase and 225 sales contracts for put VIX Options expiring in July 2017 with a strike price of 23. And between April 11, 2017, and June 13, 2017, Ms. Huang entered into 225 purchase and 225 sales contracts for put VIX Options expiring in June 2017 with a strike price of 11. Comparing both sides of these transactions to the artificiality "ribbon" indicates that Ms. Huang was harmed even if one were to apply a "net" analysis to these transactions.

292. Between March 9, 2015, and April 8, 2015, LRI Invest entered into purchase and sales contracts for call VIX Options expiring in April 2015, with a strike price of 30. Between May 18, 2017, and June 19, 2017, LRI Invest entered into purchase and sales contracts for call

VIX Options expiring in August 2017 with a strike price of 40. Between July 6, 2016 and August 17, 2016, LRI Invest entered into purchase and sales contracts for VIX Futures expiring in August 2016. Comparing both sides of these transactions to the artificiality "ribbon" indicates that LRI Invest was harmed even if one were to apply a "net" analysis to these transactions .

293. Between November 28, 2017 and December 6, 2017, John Pels entered into purchase and sales contracts for VIX Futures expiring in December 2017. Between May 26, 2017 and June 29, 2017, Mr. Pels also entered into purchase and sales contracts for VIX Options expiring in July 2017 with a strike price of 12. Comparing both sides of these transactions to the artificiality "ribbon" indicates that Mr. Pels was harmed even if one were to apply a "net" analysis to these transactions.

VI. DEFENDANTS AFFIRMATIVELY CONCEALED THEIR INHERENTLY SELF-CONCEALING MANIPULATION

294. Manipulation of the VIX and the VIX-related products at issue was material to Plaintiffs and Class members at all relevant times.

295. Within the time period of any applicable statutes of limitations, Plaintiffs and Class members could not have discovered through the exercise of reasonable diligence that Defendants were manipulating the VIX, the SOQ, or VIX products. Until recently, as a result of Defendants' misconduct and acts of concealment, Plaintiffs and Class members did not discover and did not know of any facts that would have caused a reasonable person to suspect that Defendants were manipulating the VIX or VIX-linked instruments. Plaintiffs had no prior knowledge of their claims, or of facts or information that would have caused a reasonably diligent person to investigate them.

296. Throughout the Class Period, Defendants engaged in conduct that was inherently self-concealing to those who, unlike CBOE, did not have full access to the data. The Doe

Defendants engaged in manipulative activities that were carried out at least in part, through means and methods specifically designed to avoid public detection and which, until very recently, successfully eluded public detection. The very nature and structure of the SOQ process made it impossible for Plaintiffs to discover facts comprising their claims until recently. For instance, trading of VIX Options, SPX Options, and of VIX Futures is anonymous. The Doe Defendants planned and executed their conduct in private, shielded from public view.

297. Defendants also knowingly, actively, and affirmatively concealed the facts alleged herein, including their manipulation of the VIX or VIX-linked instruments. Plaintiffs and Class members reasonably relied on Defendants' knowing, active, and affirmative concealment.

298. For instance, CBOE took affirmative steps to conceal its misconduct and, by extension, those of the Doe Defendants. CBOE affirmatively misrepresented or failed to disclose that manipulation had occurred to any meaningful degree, much less to the systemic degree that Plaintiffs' investigation has uncovered. Through its conduct, CBOE actively misled Plaintiffs as to the true nature of VIX Options and VIX Futures, as well as the SOQ process. CBOE's conduct was undertaken with the purpose and effect of masking the previously-hidden manipulation described above.

299. On June 19, 2017, for example, CBOE's chief regulatory officer Greg Hoogasian assured the public that the CBOE "has a dedicated regulatory department that works with FINRA to monitor certain trading activity for our securities markets, including trading activity that could

impact the VIX settlement."[95] With regard to the integrity of the VIX itself, CBOE officials said the VIX is a "transparent, closely regulated, and highly reliable gauge of market sentiment with no history of failure."[96] In further response to the Griffin and Shams paper, on February 13, 2018, CBOE "vehemently denied the paper's conclusions," saying that the authors "didn't consider the full range of possible reasons other than manipulation that could explain the moves they observed."[97]

300. CBOE similarly issued public denials of the whistleblower letter sent to the SEC and CFTC. CBOE Vice President Speth said that the whistleblower's letter contains "a lot of mistakes and a lot of misconceptions" and reinforced the integrity of the entire VIX settlement process: "There are structural safeguards built into the process of the calculation of the VIX settlement value that would hinder the type of manipulation the letter alleges. Our regulatory group actively surveils for potential VIX settlement manipulation."[98]

301. Plaintiffs have exercised due diligence in uncovering their claims. This includes but is not limited to trying to identify the specific traders behind the manipulation by, through counsel, seeking discovery from CBOE. With respect to the identity of the Doe Defendants, however, to date their efforts have been unsuccessful.

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[95] Elliot Blair Smith, *How S&P 500 options may be used to manipulate VIX 'fear gauge'*, MarketWatch (June 19, 2017), https://www.marketwatch.com/story/how-sp-500-options-may-be-used-to-manipulate-vix-fear-gauge-2017-06-19.

[96] *Id.* (emphasis added).

[97] Nick Baker & Cecile Vannucci, *What If Somebody Really Is Gaming the VIX?*, Bloomberg (Feb. 13, 2018), https://www.bloomberg.com/news/articles/2018-02-14/billions-in-vix-rigging-profits-a-battered-index-takes-new-hit.

[98] Saqib Iqbal Ahmed & John McCrank, *Whistleblower alleges manipulation of Cboe volatility index*, Reuters (Feb. 13, 2018), https://uk.reuters.com/article/us-usa-stocks-volatility-manipulation/whistleblower-alleges-manipulation-of-cboe-volatility-index-idUKKBN1FX0ES.

302. For these reasons, all applicable statutes of limitation have been tolled based on the discovery rule, the doctrine of equitable tolling, and/or Defendants' fraudulent concealment. Defendants are also estopped from relying on any statutes of limitations in defense of this action.[99]

CLASS ACTION ALLEGATIONS

303. Plaintiffs bring this action on behalf of themselves and as a Class action under Rules 23(a) and (b)(3) of the Federal Rules of Civil Procedure, seeking monetary damages on behalf of the following class (the "Class"):

> All persons or entities who held VIX Options or VIX Futures to expiry, or traded SPX Options, VIX Options, VIX Futures, or VIX ETPs, during the following time periods:
>
> - From March 26, 2004 to the present in the case of VIX Futures, SPX Options, and VIX ETPs; and
> - From February 24, 2006 to the present in the case of VIX Options (together, the "Class Period").[100]

304. Plaintiffs believe there are thousands of members of the Class as described above, the exact number and their identities being known by CBOE, making Class members so numerous and geographically dispersed that joinder of all members is impracticable.

305. There are numerous questions of law and fact common to each Class member, including, but not limited to:

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[99] Further, the foregoing allegations constitute a continuing violation of the antitrust laws, including misconduct and recurring injuries within the limitations period. Accordingly, Plaintiffs and the proposed Class can recover for damages suffered throughout the limitations period, even absent a finding of equitable tolling or fraudulent concealment.

[100] Excluded from the Class are Defendants and their employees, affiliates, parents, subsidiaries, whether or not named in this Complaint, and the United States government.

a. whether the SOQ settlement process for VIX Options and VIX Futures was flawed in a way that made it susceptible to manipulation and market monopolization;

b. whether CBOE knew or recklessly disregarded that the settlement process for VIX Options and VIX Futures was flawed in a way that made it susceptible to manipulation;

c. whether the SOQ process was in fact manipulated and subject to market monopolization by the Doe Defendants, in violation of the Exchange Act, the CEA, and the Sherman Act;

d. whether CBOE knew or recklessly disregarded that the SOQ settlement process was manipulated;

e. whether manipulation and market monopolization of the SOQ process had an impact upon the prices of SPX Options and VIX Options and VIX Futures, and upon the cash settlement value of VIX Options and VIX Futures;

f. whether manipulation and market monopolization of the SOQ process had an impact on the value or prices of shares or notes in VIX ETPs;

g. the identity of the Doe Defendants;

h. the duration of the manipulation and market monopolization;

i. the nature and character of the acts performed in furtherance of the manipulation and market monopolization;

j. whether the conduct of Defendants, as alleged in this Complaint, caused damages to Plaintiffs and other members of the Class and the amount and extent of those damages; and

k. the appropriate measure of damages sustained by Plaintiffs and other members of the Class.

306. Plaintiffs are members of the Class, have claims that are typical of the claims of the Class members, have interests coincident with and not antagonistic to those of the other members of the Class, and will fairly and adequately protect the interests of the members of the Class. In addition, Plaintiffs are represented by counsel who are competent and experienced in the prosecution of securities, antitrust, and class action litigation.

307. The prosecution of separate actions by individual members of the Class would create a risk of inconsistent or varying adjudications.

308. The questions of law and fact common to the members of the Class predominate over any questions affecting only individual members, including legal and factual issues relating to liability and damages.

309. A class action is superior to other available methods for the fair and efficient adjudication of this controversy. Treatment as a class action will permit a large number of similarly situated persons to adjudicate their common claims in a single forum simultaneously, efficiently and without the duplication of effort and expense that numerous individual actions would engender. The Class is readily definable and is one for which records should exist in the files of CBOE or others, and a class action will eliminate the possibility of repetitious litigation.

310. Class treatment will also permit the adjudication of relatively small claims by many members of the Class who otherwise could not afford to litigate claims such as those

asserted in this Complaint. This class action presents no difficulties of management that would preclude its maintenance as a class action.

CAUSES OF ACTION

CLAIM ONE

VIOLATION OF 15 U.S.C. § 78a, et seq.
MANIPULATION IN VIOLATION OF RULE 10(B) OF THE SECURITIES EXCHANGE ACT OF 1934 AND RULE 10B-5 PROMULGATED THEREUNDER
(AGAINST CBOE, EXCEPT CBOE FUTURES EXCHANGE, LLC)

311. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

312. This Claim is brought with respect to SPX Options and VIX Options.

313. By its misconduct, CBOE violated § 10(b) of the Exchange Act and Rule 10b-5(a) & (c) promulgated thereunder.

314. CBOE employed devices, schemes, or artifices to defraud, and engaged in acts, practices, and a course of business which operated as a fraud and deceit upon the Class, in violation of Section 10(b) of the Exchange Act and Rule 10b-5(a) & (c) promulgated thereunder. CBOE has undertaken a number of manipulative acts in furtherance of a fraudulent scheme. In so doing, CBOE acted with scienter. CBOE knew or recklessly disregarded that its proprietary products were vulnerable to manipulation—and were in fact being manipulated. CBOE nevertheless created, market, and sold its proprietary products to investors. Investors were deceived into believing that prices at which they purchased and sold CBOE's proprietary securities were determined by the natural interplay of supply and demand, not rigged by manipulators.

315. The VIX and VIX-related products at issue were central to CBOE's profit-seeking enterprise. But CBOE knew or recklessly disregarded that these products were flawed, and those

flaws were being exploited in a way that CBOE allowed or disregarded as it sought commercial gain and to maintain its dominance in the market for volatility derivatives.

316. In creating, designing, and marketing a slew of proprietary products that had flaws known only to it and the Doe Defendants, CBOE went far beyond its role as an exchange platform. CBOE's creation of these products—and its successful attempt, through its contracts with S&P, to make its VIX-related products proprietary to CBOE and unique in the marketplace—was undertaken solely to maximize its profits. Likewise, CBOE created and promoted the products that were used to manipulate the market in order to increase trading volume on CBOE's exchange and increase company profit. Thus, CBOE embarked deliberately in commercial conduct by acting as a for-profit enterprise.

317. By way of further example, CBOE's grant of special powers and even cash payment and trading fee discount rewards to certain traders during the VIX SOQ process was also not a regulatory function, but instead was commercial in nature, designed to increase CBOE's profits by generating increased trading volumes (and thus increased trading fees) for products CBOE knew or should have known were flawed.

318. CBOE's fraudulent scheme caused damage to Plaintiffs and the Class, who lost money trading SPX Options and trading and cash-settling VIX Options in reliance on the integrity of the markets for those securities and the belief the products were not manipulated. As a direct and proximate result of CBOE's deceptive and manipulative conduct, Plaintiffs and Class members have suffered damages in connection with their transactions.

319. CBOE's acts and the damage caused by them were done in connection with the purchase or sale of securities. VIX Options and SPX Options are securities that were central to

CBOE's manipulative scheme. These acts and the damage caused by CBOE were also furthered by CBOE's use of the mails or any facility of a national securities exchange.

CLAIM TWO

VIOLATION OF 7 U.S.C. § 1, et seq.
FAILURE TO ENFORCE RULES AND PREVENT PRICE MANIPULATION
IN VIOLATION OF THE COMMODITY EXCHANGE ACT
(AGAINST CBOE)

320. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

321. This Claim is brought with respect to VIX Futures.

322. By failing to enforce bylaws, rules, regulations, and resolutions despite its status as a registered entity, CBOE violated the CEA, specifically 7 U.S.C. §§ 7 and 25(b), hence allowing prices of VIX Futures to be artificial during the Class Period. Plaintiffs suffered injury as a result of transacting at these artificial prices.

323. CBOE, as a registered entity under the CEA (7 U.S.C. § 1a), engaged in actions and omissions that constitute a failure to enforce the mandatory rules that it was required to follow under the CEA, in violation of 7 U.S.C. §§ 7 and 25(b).

324. CBOE was on notice that many such rules were violated. Among other things, CBOE knew or recklessly disregarded, throughout the Class Period, that the VIX settlement value was actively manipulated. CBOE's refusal to address the manipulation taking place in the relevant markets corroborates CBOE's intent to design, list, and promote manipulated products, and constitutes a failure to enforce bylaws, rules, regulations, and resolutions.

325. CBOE's failure to do so was in bad faith. CBOE earned millions in profits from the manipulative scheme, including from transaction fees on manipulative trades, and for that

reason turned a blind eye to the manipulative activities of the Doe Defendants throughout the Class Period.

326. CBOE's failure to enforce such rules was conducted with knowledge or with reckless disregard of the violations, thus depriving Plaintiffs and the Class of a lawfully operating market during the Class Period.

327. Plaintiffs and the Class transacted at artificial and unlawful prices resulting from CBOE's failure to enforce the rules in violation of the CEA, 7 U.S.C. § 1, *et seq*., and as a direct result were injured and suffered actual damages.

CLAIM THREE[101]

ORDINARY NEGLIGENCE (AGAINST CBOE)

328. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

329. This Claim is brought with respect to VIX Futures, VIX Options, and SPX Options.

330. CBOE owed Plaintiffs and the Class a duty of reasonable care with respect to the design and testing of the VIX calculation process, the SOQ settlement process, VIX Futures, VIX Options, and SPX Options. VIX, VIX Futures, VIX Options, and SPX Options are proprietary commercial products that CBOE created for profit and with the expectation that Plaintiffs and the Class would purchase VIX Futures, VIX Options, and SPX Options.

[101] This complaint includes "Claim Three" for negligence against CBOE, notwithstanding the Court's dismissal of that claim with prejudice, Dkt. 245 at 30-32, for clarity and reference, including in respect of any potential appeal of that dismissal.

331. CBOE also owed Plaintiffs and the Class a duty of reasonable care with respect to the promotion of the VIX, VIX Futures, VIX Options, and SPX Options. CBOE has promoted the VIX, VIX Futures, VIX Options, and SPX Options as fundamentally sound and appropriate investment vehicles. It did so to induce Plaintiffs and the Class to purchase VIX Futures, VIX Options, and SPX Options.

332. CBOE negligently performed these duties. It failed to use reasonable care in its designing and testing to ensure that VIX Futures, VIX Options, and SPX Options were not susceptible to manipulation. It also failed to use reasonable care in its promotional activities to ensure that investors were apprised of the risk of manipulation of VIX Futures, VIX Options, and SPX Options.

333. Plaintiffs and the Class suffered damages as a result of CBOE's breach of its duties of care.

CLAIM FOUR

VIOLATION OF 15 U.S.C. § 78a, et seq.
MANIPULATION IN VIOLATION OF RULE 10(B) OF THE SECURITIES EXCHANGE ACT OF 1934 AND RULE 10B-5 PROMULGATED THEREUNDER
(AGAINST DOE DEFENDANTS)

334. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

335. This Claim is brought with respect to SPX Options, VIX Options, and VIX ETPs.

336. By their misconduct, the Doe Defendants violated §10(b) of the Exchange Act and Rule 10b-5 promulgated thereunder.

337. The Doe Defendants employed devices, schemes, and artifices to defraud, and engaged in acts, practices, and a course of business which operated as a fraud and deceit upon

the Class, in violation of Section 10(b) of the Exchange Act and Rule 10b-5 promulgated thereunder.

338. The Doe Defendants have undertaken a number of manipulative acts in furtherance of a fraudulent scheme. The Doe Defendants have, for example, banged the close, manipulated the two-zero bid rule, and submitted false bids and offers throughout the Class Period. These actions systematically manipulated SPX Options prices, VIX Options prices and settlements, and VIX ETP values throughout the Class Period.

339. The manipulative acts of the Doe Defendants caused damage to the Plaintiffs and the Class. Specifically, the Doe Defendants manipulated settlement values so that they could gain large cash windfalls, or avoid large cash expenses, or both. These illicit gains were made at the expense of the Class. As a direct and proximate result of the Doe Defendants' wrongful conduct the Class has suffered damages in connection with the settlement of VIX Options. Similarly, the manipulative acts of the Doe Defendants had a direct impact upon prices for SPX Options and VIX Options, and the value of shares and notes in VIX ETPs, again at the direct and proximate expense of the Class.

340. Throughout the Class Period, Plaintiffs and the Class relied on an assumption of an efficient market free of manipulation. Investors believed they were trading in competitive markets where prices driven by supply and demand. The Doe Defendants employed devices, schemes, and artifices to defraud while in possession of material, adverse, non-public information, specifically, they improperly manipulated the VIX settlement value, and the prices of VIX Options, the prices of SPX Options, and the prices of notes and shares in VIX ETPs, as detailed in this Complaint.

341. The Doe Defendants, individually and in concert, directly and indirectly, by the use, means or instrumentalities of interstate commerce and/or of the mails, engaged and participated in a continuous course of conduct to conceal their manipulation.

CLAIM FIVE

VIOLATION OF 7 U.S.C. § 1, et seq.
MANIPULATION IN VIOLATION
OF THE COMMODITY EXCHANGE ACT
(AGAINST DOE DEFENDANTS)

342. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

343. This Claim is brought with respect to VIX Futures.

344. By their intentional misconduct, the Doe Defendants violated the CEA, specifically 7 U.S.C. §§ 6b(a), 6c(a), 9(3), 13(a)(2), 25(a), and CFTC rules adopted under the CEA (17 C.F.R. § 180.2), and caused prices of VIX Futures to be artificial during the Class Period.

345. The Doe Defendants' trading and other activities alleged herein constitute market manipulation of prices of VIX Futures, in violation of 7 U.S.C. §§ 6b(a), 6c(a), 9(3), 13(a)(2), 25(a), and 17 C.F.R. § 180.2.

346. The Doe Defendants had the motive and the opportunity to manipulate the VIX settlement process.

347. The Doe Defendants also possessed an ability to influence market prices through the manipulative schemes described above. Specifically, the Doe Defendants banged the close on VIX settlement days, manipulated the two-zero bid rule to ensure certain strikes would be used in the settlement computation, and submitted false bids and offers to manipulate the VIX settlement price.

348. The Doe Defendants caused the artificial prices through their manipulative activities. They did so manipulating the prices of the SPX Options that CBOE used in its VIX settlement calculation, and by influencing the levels of bids and asks associated with each of those SPX Options.

349. The Doe Defendants specifically intended to cause the artificial VIX Futures prices. The Doe Defendants knew they would experience large cash windfalls or prevent large cash payouts if they were successfully able to shift the settlement value. This provided ample motivation for the Doe Defendants to purposefully shift the settlement value artificially upwards or downwards. The Doe Defendants also had the opportunity to do so because they executed their SPX Option trades in the narrow time window of the SOQ auction, which had a large influence on the ultimate VIX price.

350. The Doe Defendants' manipulation deprived the Class of a lawfully operating market during the Class Period.

351. Plaintiffs and the Class transacted at artificial and unlawful prices resulting from the Doe Defendants' manipulations in violation of the CEA, 7 U.S.C. § 1, *et seq*., and Rule 180.2, and as a direct result thereof were injured and suffered damages. Plaintiffs and the Class sustained and are entitled to actual damages for the violations of the CEA alleged therein.

CLAIM SIX

VIOLATION OF 7 U.S.C. § 1, et seq.
EMPLOYMENT OF MANIPULATIVE OR DECEPTIVE DEVICE
OR CONTRIVANCE IN VIOLATION OF THE COMMODITY EXCHANGE ACT
(AGAINST DOE DEFENDANTS)

352. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

353. This Claim is brought with respect to VIX Futures.

354. By their intentional misconduct, from August 15, 2011 to present, the Doe Defendants each violated the CEA, specifically 7 U.S.C. §§ 9(1), 13(a), and CFTC rules adopted under the CEA (17 C.F.R. § 180.1), and caused prices of VIX Futures to be artificial during the Class Period.

355. The Doe Defendants' trading and other activities alleged herein constitute market manipulation of prices of VIX Futures, in violation of the CEA, 7 U.S.C. §§ 9(1), 13(a), 25(a), and 17 C.F.R. § 180.1.

356. The Doe Defendants have delivered or transmitted numerous false, misleading, or inaccurate reports relating to their activities in the markets for VIX Futures. Specifically, the Doe Defendants have submitted false bids and offers into the SOQ process with the intent of sending false market information to buyers and sellers of VIX Futures. They have done so on every occasion where they have manipulated the VIX settlement value to benefit their financial positions.

357. The Doe Defendants had knowledge of the impact these false reports would have on the marketplace. In fact, the Doe Defendants intended to mislead the market in this manner to benefit their financial positions. There would be no reason to undertake the manipulative scheme described herein if there would be no impact on the relevant markets.

358. There is also no legitimate justification for the false reports. The only reason to manipulate the SOQ process, and thus the VIX settlement value, was to introduce artificiality into, e.g., the prices for VIX Futures.

359. The Doe Defendants' manipulation deprived the Class of a lawfully operating market during the Class Period.

360. Plaintiffs and the Class transacted at artificial and unlawful prices resulting from the Doe Defendants' manipulations in violation of the CEA, 7 U.S.C. § 1, *et seq.*, and Rule 180.1, and as a direct result thereof were injured and suffered damages. Plaintiffs and the Class also suffered damages under 17 C.F.R. 180.1(a)(1).

CLAIM SEVEN

VIOLATION OF 7 U.S.C. § 1, et seq.
PRINCIPAL-AGENT LIABILITY
IN VIOLATION OF THE COMMODITY EXCHANGE ACT
(AGAINST ALL DEFENDANTS)

361. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

362. This Claim is brought with respect to VIX Futures.

363. Each Defendant is liable under the CEA (7 U.S.C. § 2(a)(1)(B)), for the manipulative acts of their agents or representatives (including both corporate and natural persons) as well as any persons acting for them in the scope of their employment.

364. Plaintiffs and the Class were harmed as a result of trading at manipulated prices and are entitled to actual damages for the violations of the CEA alleged herein.

CLAIM EIGHT

VIOLATION OF 7 U.S.C. § 1, et seq.
AIDING AND ABETTING LIABILITY
IN VIOLATION OF THE COMMODITY EXCHANGE ACT
(AGAINST ALL DEFENDANTS, EXCEPT CBOE FUTURES EXCHANGE, LLC)

365. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

366. This Claim is brought with respect to VIX Futures.

367. Defendants knowingly aided, abetted, counseled, induced, and/or procured the violations of the CEA alleged herein. Defendants did so knowing of each other's manipulation of VIX Futures, and willfully intended to assist these manipulations, which resulted in the prices of VIX Futures becoming artificial during the Class Period in violation of the CEA (7 U.S.C. §§ 13c(a) and 25(a)(1)). CBOE knew of the manipulation alleged herein—manipulation that, in substantial part, it engineered, oversaw, and furthered through its acts and omissions—and intended to further that manipulation for the sake of its profits and the success of its VIX franchise.

368. Plaintiffs and the Class were harmed as a result of trading at manipulated prices and are entitled to actual damages for the violations of the CEA alleged herein.

CLAIM NINE

VIOLATION OF §1 OF THE SHERMAN ACT, 15 U.S.C § 1 (AGAINST DOE DEFENDANTS)

369. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

370. This claim is brought with respect to VIX Options, VIX Futures, SPX Options, and VIX ETPs.

371. The Doe Defendants combined, conspired, and agreed to manipulate the prices of VIX Options, VIX Futures, SPX Options, and VIX ETPs. This combination, conspiracy, and/or agreement unreasonably restrained trade in violation of the federal antitrust laws.

372. Specifically, the anticompetitive combination, conspiracy, and/or agreement alleged herein is a per se violation of Section 1 of the Sherman Act, 15 U.S.C. § 1 ("Section 1"). Alternatively, the anticompetitive combination, conspiracy, and/or agreement alleged herein

resulted in substantial anticompetitive effects in the market for VIX Options, VIX Futures, SPX Options, and VIX ETPs in the United States in violation of Section 1.

373. The Doe Defendants intended to restrain trade and actually restrained trade in violation of Section 1. These Defendants shared a conscious commitment to the common scheme designed to achieve the unlawful objective of manipulating the prices of VIX Options, VIX Futures, SPX Options, and VIX ETPs.

374. The anticompetitive combination, conspiracy, and/or agreement alleged herein unreasonably restrained trade, and there is no legitimate business justification for, or procompetitive benefits of, the Doe Defendants' unreasonable restraint of trade. Any alleged procompetitive benefit or business justification is pretextual and/or could have been achieved through less restrictive means.

375. The anticompetitive combination, conspiracy, and/or agreement alleged herein occurred within the flow of and substantially affected interstate commerce.

376. As a direct and proximate result of these Defendants' anticompetitive scheme and concrete acts in furtherance of that scheme, Plaintiffs and members of the Class have been injured in their business and property by reason of Defendants' violation of Section 1, within the meaning of Section 4 of the Clayton Antitrust Act, 15 U.S.C. § 15.

377. Plaintiffs' and the Class's injuries are of the type the antitrust laws were designed to prevent and are a direct result of the Doe Defendants' unlawful anticompetitive conduct.

378. Plaintiffs and the Class are entitled to treble damages for the violations of the Sherman Act alleged herein.

CLAIM TEN

VIOLATION OF § 2 OF THE SHERMAN ACT, 15 U.S.C. § 2 (AGAINST DOE DEFENDANTS)

379. Plaintiffs incorporate each preceding and succeeding paragraph as though fully set forth herein.

380. This Claim is brought with respect to VIX Options, VIX Futures, SPX Options, and VIX ETPs.

381. Each of the Doe Defendants traded and placed orders for SPX Options to manipulate the SOQ settlement process for expiring VIX Options and VIX Futures so that they could gain large cash windfalls, or avoid large cash expenses, or both.

382. The Doe Defendants' trades and orders for SPX Options were at non-competitive prices that purposely inflated or depressed prices for SPX Options, VIX Options, VIX Futures, and VIX ETPs in a direction that benefited the Doe Defendants.

383. The Doe Defendants possessed monopoly power and willfully maintained that power through their intent and ability to dictate the SOQ settlement prices.

384. The Doe Defendants used their monopoly power to dictate the SOQ settlement prices, including to set those prices at artificial levels by trading SPX Options, in order to prevent free markets from operating, and in order to move the prices for SPX Options, VIX Options, VIX Futures, and VIX ETPs in a direction that benefited the Doe Defendants.

385. The Doe Defendants' ability to control prices is demonstrated by the anomalous patterns demonstrated in Plaintiffs' experts' economic analyses.

386. The Doe Defendants' conduct has no legitimate business purpose or procompetitive effect.

387. Plaintiffs and the Class have suffered and will suffer economic injury of the type that the antitrust law were intended to prevent.

388. Plaintiffs and the Class have been injured and will be injured by the harm to competition as a result of the Doe Defendants' conduct.

PRAYER FOR RELIEF

389. WHEREFORE, Plaintiffs, on behalf of themselves and the proposed Class of similarly situated persons and entities, respectfully request:

a. That the Court certify this lawsuit as a class action under Rules 23(a) and (b)(3) of the Federal Rules of Civil Procedure, that Plaintiffs be designated as class representatives, and that Plaintiffs' counsel be appointed as Class counsel for the Class;

b. For a judgment awarding Plaintiffs and the Class damages, as well as punitive or exemplary damages, against Defendants for their violations of the Exchange Act, and the CEA, together with prejudgment interest at the maximum rate allowable by law;

c. For an award to Plaintiffs and the Class of their costs of suit, including reasonable attorneys' and experts' fees and expenses; and

d. For such other and further relief as the Court may deem just and proper.

JURY DEMAND

Pursuant to Federal Rule of Civil Procedure 38, Plaintiffs, on behalf of themselves and the proposed Class, demand a trial by jury on all issues so triable.

Dated: August 23, 2019

Respectfully submitted,

By: */s/ Jonathan C. Bunge*

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CERTIFICATE OF SERVICE

I, Jonathan C. Bunge, hereby certify that on August 23, 2019, I electronically filed the foregoing document using the CM/ECF system, and have verified that such filing was sent electronically using the CM/ECF system to all parties who have appeared with an email address of Record.

/s/ Jonathan C. Bunge
Co-Lead Counsel